## THE 25 SMARTEST CITIES IN THE WORLD

THE BEST PLACES FOR STARGAZERS, BIRD-WATCHERS, CHESS PLAYERS, YODELERS, AND BATMAN FANS P.22

FEEL SMART AGAIN

# mental_floss

# THE IMPOSSIBLE ISSUE

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*PLUS!*

## LIFE AS A GOAT

**ONE MAN'S AMAZING TRUE STORY** P.34

JULY/AUGUST 2016
VOLUME 15, ISSUE 4
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# DO THE IMPOSSIBLE!

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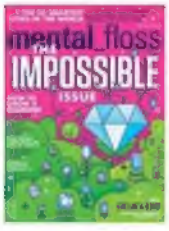


Cover by Skinny Ships

TIM BOWDITCH

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ALAMY (ROBOT, CURRY, STAR TREK) ISTOCK (TELESCOPE, SURFBOARD, DIAMOND, WATERMELON) RYAN INZANA (MOON)

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# MISSION: IMPOSSIBLE

Recently, I pulled a total daredevil move and boarded a flight with my 3-month-old. As she dozed through takeoff, I watched previews for the in-flight entertainment. There were plenty of options, including Oscar nominees I was dying to see. But there are a lot of minor impossibilities involved in being a new mother, and sitting through a whole movie is near the top of the list. So I settled on a remake of the 1990s surfing–crime spree classic *Point Break*, thinking I could tune in and out.

I don't think I'm spoiling it when I tell you it's about an extreme athlete–turned–FBI agent who infiltrates an extreme athlete–crime syndicate on a mission to complete a series of impossible physical feats and commit a series of extraordinary crimes. (At least one surfing crime syndicate actually did exist in history—see page 62.) There's a lot of beautiful scenery and unbelievable stunts. And there's a lot of waxing vaguely poetic about the allure of DOING THE IMPOSSIBLE. I giggled watching it, because it was absurd, but also because it struck me how very different the *mental_floss* definition of an "impossible" feat is from Hollywood's.

Because for this issue, we were knee-deep in a story about a guy who tries to become a goat. (Not dress up as a goat, but rather, logistically and philosophically become a goat. There's a lot to unravel—we attempt on page 34.) Another is about a company that's growing diamonds in an atomic oven, creating in two weeks something that takes eons to form in the Earth's crust (page 54). There's also a story about the architectural mission to build one of the world's tallest skyscrapers (page 18), and one about an incredible feat of conservation: the librarians who shuttled Mali's ancient books out of the way of extremist destruction (page 42).

That there are so many ways of defining "impossible" is proof of how basic the desire to attempt it must be to the human condition. Waxing vaguely poetic about this myself, another film came to mind: the artsy-thinky romance *Before Sunrise*, which is about two people having a very long chat. "If there's any kind of magic in this world it must be in the attempt of understanding someone," says one to the other. "It's almost impossible to succeed, but ... the answer must be in the attempt."

I think that's why we love stories about impossible things, whether or not their endings are "happy." I won't ruin *Point Break* for you, but this story has one: I accomplished my own improbable feat! The baby slept the entire movie, through the credits, and well into the second showing, so I watched it one and a half times (I was afraid to move to change the channel). If that doesn't scream impossible, I don't know what does.

jessanne

@jessanne

ISTOCK

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**SKINNY SHIPS,** the Portland, Oregon–based duo of Richard Perez and Jennifer DeRosa, illustrated this issue's cover. They've also created icons and images for Facebook and Fitbit, and have contributed to *The New York Times* and *The Wall Street Journal*. They're now at work on their latest project: designing invitations for their wedding this fall.

"I never wanted an engagement ring, and my wedding ring is a simple $75 gold band," says **ALINA SIMONE.** Still, in the process of writing "How to Make a Diamond" (page 54), she "developed a tiny case of man-made-diamond jewelry lust." Simone has also contributed to *The New York Times*, *The Wall Street Journal*, and *Elle*. She's working on a story about Americans training to become Korean pop stars.

**BETHLEHEM SHOALS** (pictured) and **SILVERBIRD 5000** are the noms de plume of two core members of the acclaimed, now-defunct basketball blog FreeDarko. They got back together for this issue's guide to NBA superstar Stephen Curry (page 50). Their book, *FreeDarko Presents: The Undisputed Guide to Pro Basketball History*, is in stores now.

This issue's impossible theme (page 34) had **ERIC NYFFELER** researching everything from pope hats to mixed martial arts fighters. "I didn't expect I'd ever have to google 'Jerry Maguire VHS' in a professional context," says the illustrator, who has also collaborated with Nike, Target, and Whole Foods. "For pleasure, sure. But never for work!"

COURTESY SKINNY SHIPS. MATTHEW SPENCER (SIMONE). COURTESY SHOALS. DANIEL MULLER (NYFFELER)


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Lots of gems in *mental_floss* mag for word lovers!

@gmcgarv

In honor of #World Penguin Day I thought I would share a great page from *mental_floss*. Hug a penguin!

@AnArtfulPenguin

Hey *mental_floss*, just added the app for Smiling Mind to my tablet. We'll see how it goes. Mindfulness, here I come.

@Cindyrochel

We are so happy to be named in *mental_floss* magazine as one of the "10 Services You Never Knew You Needed"

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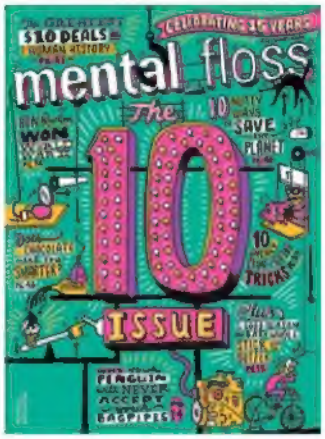
# Letter of the Month

Imagine my pleasant surprise upon reading "10 Services You Never Knew You Needed" [May/June 2016], which featured my business, Rent A Grandma. We've been featured on television shows and radio stations and in newspapers, but being mentioned in your magazine has been the greatest honor I can think of. Our slogan is "always trust your Grandma." I'd like to amend it to read, "Always trust your *mental_floss*."

**—TODD PLISS, FOUNDER/CEO, RENT A GRANDMA**




### FLOATING AN IDEA

Reading the piece about the Antarctic Halley VI research station ["Welcome to the Ski Lodge," May/June 2016], I couldn't help but wonder, "Why didn't the architects make the lab buoyant?" While the skis on the bottom of the lab were an exceptional idea, what will they do if an accidental ice bath occurs?
**—Michi Vallières**

### CHRONICLES OF SARNIA

I was shocked when I discovered that the beautiful city I live in was referred to as "polluted" ["10 Nutty Proposals to Save the Planet," May/June 2016]. Sarnia, Ontario's "Chemical Valley" was once deserving of that adjective, but today, it's a jewel at the mouth of the St. Clair River where marinas and parks line the river and beaches line the Lake Huron shore.
**—Bonnie Stevenson**

### OH, THAT'S PUNNY

How did no one call the failed Dad Saddle ["Patently Absurd," May/June 2016] "The Daddle"? Just sayin'...
**—Mama Trish**

### FOLSOM GETS SAUCY

In "10 Quirky Families That Still Rule the World" [May/June 2016], you wrote that "Every bottle of Kikkoman soy sauce you buy in the United States comes not from Japan, but Wisconsin." But Kikkoman also manufactures soy sauce in Folsom, California! Gekkeikan also makes sake there.
**—Jon Wiltshire**

### OUR NEW CLASSICS

The story on Robert Frank's *The Americans* was fantastic ["The Big Picture," January/February 2015]. It grabbed me by the throat and wouldn't set me down until the end. I had to buy the book.
**—Lysa Wright**

*Thanks, Lysa! We're now showcasing our favorite longer stories, past and present, with a fancy new treatment at mentalfloss.atavist.com.*

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QQ282

THIS MONTH'S THEME

**SPACE**

# EARTHLINGS SEEK PEN PALS

*Dear aliens: We've been sending you messages for years. Why haven't you written back?*

BY **SALLY GAO**

**IN 1974,** the Arecibo radio telescope in Puerto Rico, originally built to study Earth's upper atmosphere, beamed the first messages into deep space. Dr. Frank Drake of Cornell University created a note that, when decoded from radio waves to binary, formed an illustrated message hinting at human intelligence. It featured the atomic numbers for basic elements, a representation of DNA, the numbers one through 10, a drawing of the radio telescope, and a blocky figure of a human. The signal, which was 10 million times stronger than the radio signals emitted by the sun, was pointed at a star cluster called M13—located about 21,000 light-years away. Judging by the radio silence, we can only assume it hasn't reached intelligent life yet. That, or the aliens weren't impressed by our artistic skills.

## + 6 Unlikely Things We've Sent to Space

**1**

**NUDIE PICS**

Launched in 1972, the *Pioneer 10* space probe was designed to cruise by Jupiter, photograph the gas giant, and zoom into deep space. Nobody thought to leave a note on board for aliens, but just before launch, scientists turned the probe into an intergalactic mail truck. Currently eight billion miles away from home, it's carrying diagrams of Earth's location and—*gasp!*—drawings of a naked man and woman.

**2**

**GREETINGS IN 55 LANGUAGES**
NASA spacecrafts *Voyager 1* and *Voyager 2*, launched in 1977 to explore the solar system, each carry 12-inch record players with instructions on how to assemble and use them. Along with nature sounds like wind, rain, and ocean waves, the records that accompany them contain greetings in 55 languages (from the ancient Babylonian language of Akkadian to the modern Chinese dialect of Wu).

**3**

**JIMMY CARTER**
These same gold-plated discs also contain a letter from Jimmy Carter, the president at the time: "This is a present from a small distant world, a token of our sounds, our science, our images, our music, our thoughts, and our feelings ... We hope someday, having solved the problems we face, to join a community of galactic civilizations." Carter's message is now 12 billion miles from Earth.

CLEVER SCHEMES

# APOLLO'S ACTUARY

*When astronauts couldn't get life insurance, they used their star power for coverage.*

BY **JULIE WINTERBOTTOM**

**BEFORE HE SET OUT** for the moon in July 1969, Neil Armstrong had to deal with a pedestrian chore: buying life insurance. Armstrong and crewmates Buzz Aldrin and Michael Collins were about to attempt one of the riskiest voyages in human history, and not many companies wanted to cover the risk. The crew knew there was a good chance they might not make it back to Earth, and they wanted to make sure their families were provided for. But life insurance, at $50,000 a pop (more than $330,000 today), cost way beyond what the crew could afford on government salaries.

Eventually, two Houston companies volunteered to pay the premium for a basic policy, but the astronauts wanted additional coverage—so they mounted their own insurance policy. Long before the mission began, the *Apollo 11* astronauts were already celebrities, and there was a demand for their autographs. So during a monthlong quarantine prior to the launch, Armstrong, Aldrin, and Collins spent their free time signing hundreds of commemorative envelopes emblazoned with silk-screened images of the upcoming moon landing. These envelopes, later called "insurance covers," were left with an astronaut friend who postmarked some on the day of the launch and others on the day of the touchdown. He then gave the signed envelopes to the astronauts' families, who could sell them for cash in the event of a disaster.

Thankfully, the *Apollo 11* mission was a success and the families never had to sell the covers. But the DIY insurance scheme took off among astronauts. The crews of the next five *Apollo* missions all signed insurance covers, and many of the original *Apollo 11* envelopes became collectibles. In 2013, an *Apollo 11* insurance cover fetched $50,788—enough to buy life insurance (or maybe something slightly more exciting).

**4**

**AN INTERGALACTIC CONCERT**
In 2001, Russian astronomer Alexander Zaitsev enlisted a group of Russian teenagers over the Internet to compose a message to aliens. The result? "The First Theremin Concert for Extraterrestrials." The teens selected melodies—from Russian folk music to Gershwin's "Summertime"—which were performed and recorded on the instrument. The concert was broadcast to six sunlike stars.

**5**

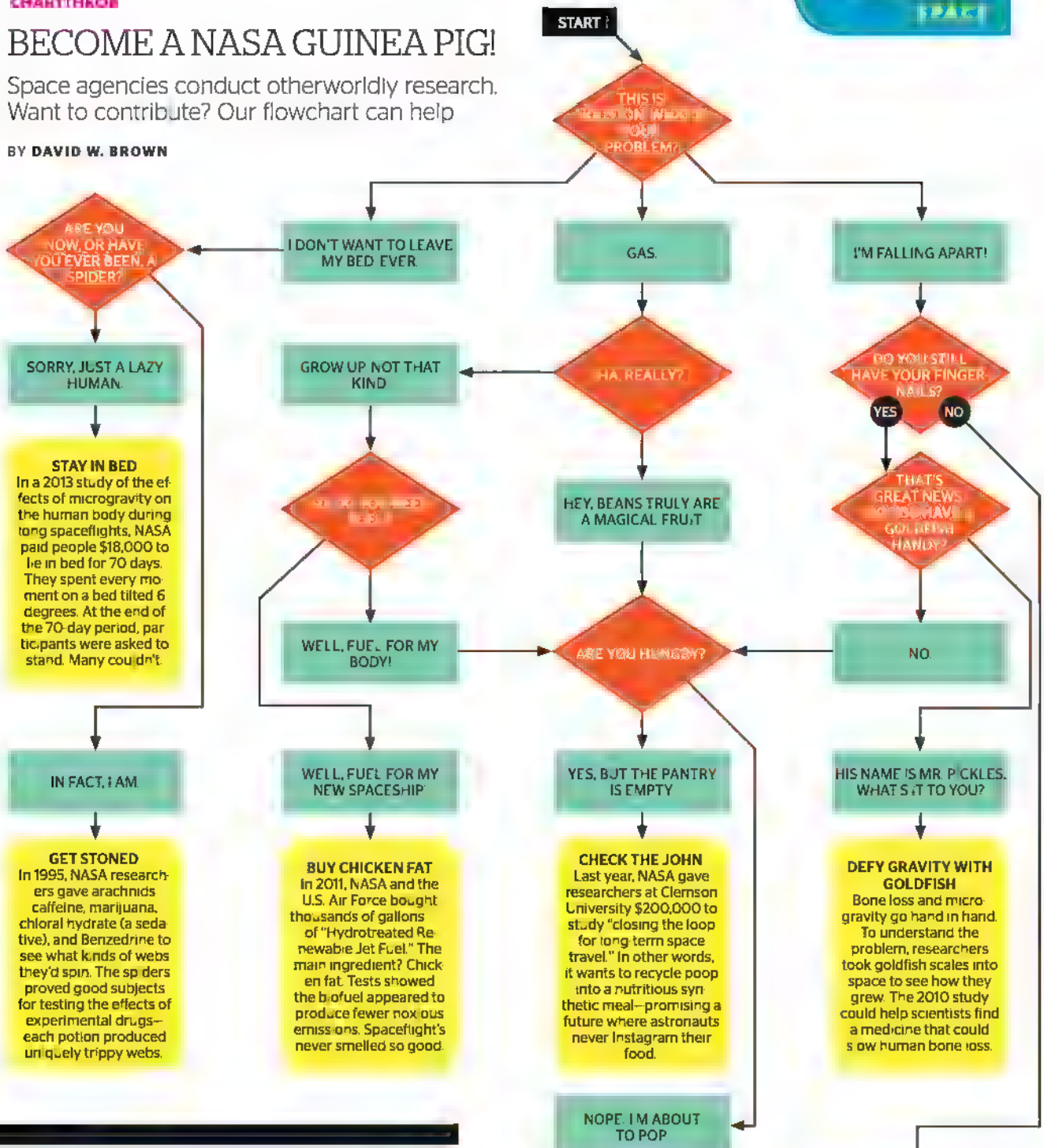
**VAGINAL CONTRACTIONS**
Joe Davis, an unofficial artist in residence at MIT, believed scientists did a shoddy job explaining the birds and the bees to aliens. So in 1986, Davis recorded the vaginal contractions of Boston Ballet dancers and beamed the radio signals into space. When an Air Force officer got wind of the project, he ordered it shut down. But not before Davis transmitted his recording for a few minutes.

CHARTTHEORY

# BECOME A NASA GUINEA PIG!

Space agencies conduct otherworldly research. Want to contribute? Our flowchart can help

BY **DAVID W. BROWN**


START
THIS IS [illegible] OUR PROBLEM?
I DON'T WANT TO LEAVE MY BED. EVER.
GAS.
I'M FALLING APART!
ARE YOU NOW, OR HAVE YOU EVER BEEN, A SPIDER?
SORRY, JUST A LAZY HUMAN.
STAY IN BED
In a 2013 study of the effects of microgravity on the human body during long spaceflights, NASA paid people $18,000 to lie in bed for 70 days. They spent every moment on a bed tilted 6 degrees. At the end of the 70-day period, participants were asked to stand. Many couldn't.
IN FACT, I AM.
GET STONED
In 1995, NASA researchers gave arachnids caffeine, marijuana, chloral hydrate (a sedative), and Benzedrine to see what kinds of webs they'd spin. The spiders proved good subjects for testing the effects of experimental drugs—each potion produced uniquely trippy webs.
GROW UP. NOT THAT KIND.
HA. REALLY?
[illegible]
WELL, FUEL FOR MY BODY!
WELL, FUEL FOR MY NEW SPACESHIP
BUY CHICKEN FAT
In 2011, NASA and the U.S. Air Force bought thousands of gallons of "Hydrotreated Renewable Jet Fuel." The main ingredient? Chicken fat. Tests showed the biofuel appeared to produce fewer noxious emissions. Spaceflight's never smelled so good.
HEY, BEANS TRULY ARE A MAGICAL FRUIT
ARE YOU HUNGRY?
YES, BUT THE PANTRY IS EMPTY
CHECK THE JOHN
Last year, NASA gave researchers at Clemson University $200,000 to study "closing the loop for long-term space travel." In other words, it wants to recycle poop into a nutritious synthetic meal—promising a future where astronauts never Instagram their food.
NOPE. I'M ABOUT TO POP
GET GASSED
During the early days of space travel, farts were a major safety concern. Zero gravity makes it impossible to belch and pushes gas to the lower intestine. That methane was a fire hazard in an oxygenated capsule, so NASA had to study "rectal gases" and diets to reduce them.
DO YOU STILL HAVE YOUR FINGERNAILS?
YES
NO
THAT'S GREAT NEWS. DO YOU HAVE GOLDFISH HANDY?
NO.
HIS NAME IS MR. PICKLES. WHAT'S IT TO YOU?
DEFY GRAVITY WITH GOLDFISH
Bone loss and microgravity go hand in hand. To understand the problem, researchers took goldfish scales into space to see how they grew. The 2010 study could help scientists find a medicine that could slow human bone loss.
BUY BUBBLE WRAP
Astronauts wear special pressurized gloves during space walks. But there's one problem: They can make your fingernails fall off. One solution? Researchers have designed skintight space suits—essentially, human shrink-wrap.

**A DORITOS AD**
In 2008, Doritos advertised from the EISCAT radar facility on the Norwegian archipelago of Svalbard. The message, a video file converted to binary, was broadcast repeatedly in the direction of the constellation Ursa Major. The location is a habitable zone that may contain liquid water, so if there are aliens anywhere, that's a good place to hit them with some Cool Ranch advertising.

ART BEAT

# CONNECTING THE DOTS

*You may recognize the constellations—but other cultures through the ages saw the same stars in a different light.*

ILLUSTRATION BY **BILL REBHOLZ**

## THE PLEIADES
"The Seven Sisters"

In Hindu astrology, the Krittika, a lunar mansion meaning "the cutters," is represented by a fire, knife, or **meat cleaver**. It signifies the power to cut away negativity and shine light on deeper truths.

According to Onondaga Iroquois legend, **seven children** danced themselves silly and grew so lightheaded that they rose into the sky. (The dimmest star is said to be homesick.)[1]

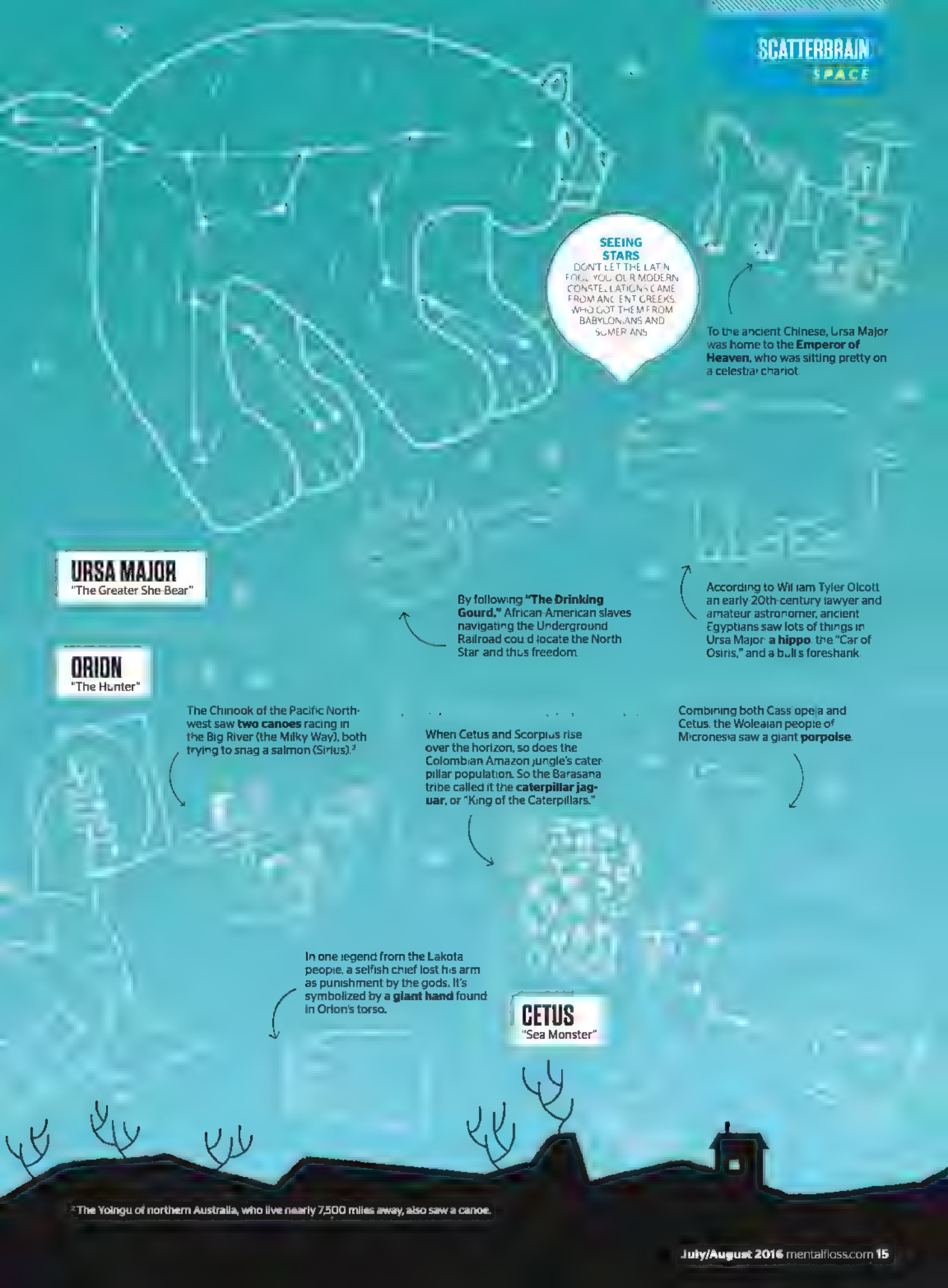
## CASSIOPEIA
"The Vain Queen"

In Alaska, the Inuit called the stars *Ursuutaattiaq*, meaning "seal skin oil or **blubber container**."

In the Pacific Northwest, the Yakama tribe saw an **elk skin**. As the story goes, the hide was stretched with wooden stakes, and the puncture holes formed stars.

To ancient Hindus, the W-shaped constellation was like a **waterfall** pouring from the North Celestial Pole.

[1] The Western Mono tribe of the Sierra Nevada mountains saw six wives. Legend has it the ladies were hiking, discovered some onions, and smelled so bad their husbands tossed them out—and into the stars.



**SEEING STARS**
DON'T LET THE LATIN FOOL YOU. OUR MODERN CONSTELLATIONS CAME FROM ANCIENT GREEKS, WHO GOT THEM FROM BABYLONIANS AND SUMERIANS

To the ancient Chinese, Ursa Major was home to the **Emperor of Heaven**, who was sitting pretty on a celestial chariot.

## URSA MAJOR
"The Greater She-Bear"

By following **"The Drinking Gourd,"** African-American slaves navigating the Underground Railroad could locate the North Star and thus freedom.

According to William Tyler Olcott, an early-20th-century lawyer and amateur astronomer, ancient Egyptians saw lots of things in Ursa Major: a **hippo**, the "Car of Osiris," and a bull's foreshank.

## ORION
"The Hunter"

The Chinook of the Pacific Northwest saw **two canoes** racing in the Big River (the Milky Way), both trying to snag a salmon (Sirius).[2]

When Cetus and Scorpius rise over the horizon, so does the Colombian Amazon jungle's caterpillar population. So the Barasana tribe called it the **caterpillar jaguar**, or "King of the Caterpillars."

Combining both Cassiopeia and Cetus, the Woleaian people of Micronesia saw a giant **porpoise**.

In one legend from the Lakota people, a selfish chief lost his arm as punishment by the gods. It's symbolized by a **giant hand** found in Orion's torso.

## CETUS
"Sea Monster"

[2] The Yolngu of northern Australia, who live nearly 7,500 miles away, also saw a canoe.

DREAM VACATION

# 6 THINGS TO KNOW ABOUT THE STARRIEST ISLAND ON EARTH

*In 2011, the International Dark-Sky Association deemed Sark, a quaint retreat off the coast of Normandy, the world's first "dark sky island." It's among the most beautiful places to stargaze—and the strangest.*

**1**

**FEUDALISM'S LAST HURRAH**

When King John of England lost Normandy to France in the 1200s, Sark stayed loyal to Britain, and the island was granted autonomy. It would become the longest-running feudal state in the world, lasting until 2008. An underclerk lord called the Seigneur still oversees Sark's government.

**2**

**CHEAP RENT!**

When Queen Elizabeth I granted Sark a fiefdom in 1565, she had one stipulation: The feudal lord had to pay an annual fee of £1.79 to lease the island from the Crown. The Queen didn't consider inflation, so that rate has never changed. To this day, the Seigneur rents the entire island for less than $3.

**3**

**A GREAT RÉSUMÉ BOOST**

Since the island has no income tax, Sark was a popular tax shelter in the 1980s. To obtain an island address, international companies often paid Sark residents to sit on their boards. "One inhabitant of Sark was on the board of 2,000 companies," reports the *Institutional Investor*.

**4**

**SARK'S STRANGE RULES**

Only the Seigneur can keep pigeons or, until 2008, an unspayed dog. Divorce, cars, and aircraft are banned, and hanging was on the books until 2004. There are no streetlights. The island does have two ambulances and two fire trucks, but the villagers removed the engines, so they have to be pulled by a tractor.

**5**

**THE WORLD'S COMFIEST JAIL**

Sark's police force, consisting of two volunteer constables, maintains the island's two jail cells. Due to little crime, the cells are rented to tourists. (Pro tip: To bring somebody to court, drop to one knee, recite the Lord's Prayer in Norman French, and state the *Clameur de haro*.[1])

**6**

**A LINGUISTIC BALL PIT**

Sark is an English Channel Island, but its laws and street signs are written in French. And that's not even the most confusing part. The oldest Sarkese speak a fading Norman patois called *Sercquiais*, which traces back to 16th-century settlers who immigrated from the nearby island of Jersey.

[1] That is, say: "Haro, haro, haro! A mon aide mon prince, on me fait tort!" The offender must then go to court. The last time somebody tried this was in 1970 (over a fight about a garden wall).

SUE DALY

# 4 GALACTIC GOOD GUESSES

Humanity's best efforts at unraveling the universe's mysteries

BY **LIVIUS DRUSUS**

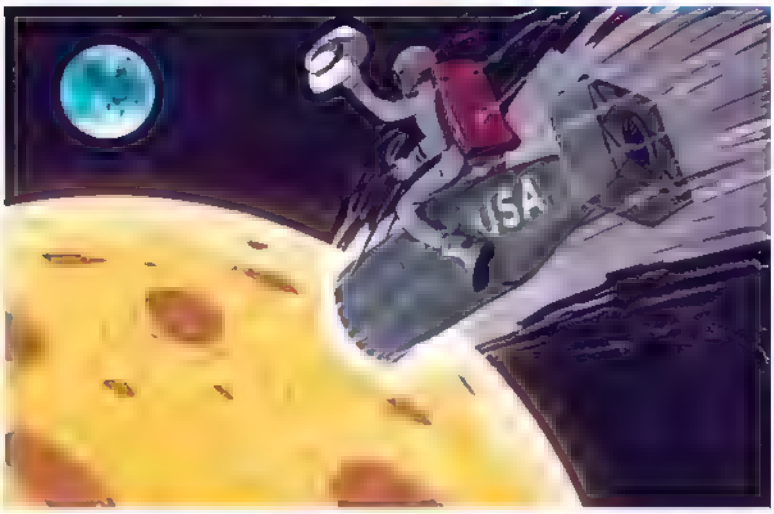
**THE MOON IS TRANSLUCENT.**
**Date:** 1377
**Who:** Nicole Oresme, French polymath
**QUOTE:** "[The moon is] a perfectly polished ... transparent and clear body such as crystal or glass."

**THERE ARE ALIENS ON THE SUN.**
**DATE:** 1440
**WHO:** Nicholas of Cusa, German astronomer
**QUOTE:** "It may be conjectured that in the area of the sun there exist solar beings, bright and enlightened denizens, and by nature more spiritual than such as may inhabit the moon—who are possibly lunatics—whilst those on earth are more gross and material."

**EVERYTHING IS LIGHT.**
**DATE:** 1225
**WHO:** Robert Grosseteste, English bishop
**QUOTE:** "So light, by its nature, is infinitely multiplying itself everywhere and stretching uniformly in every direction, at the beginning of time, extended matter, drawing it out, along with itself into a mass the size of the world machine."

**THERE ARE STARS BETWEEN EARTH AND THE SUN.**
**DATE:** 1612
**WHO:** Christoph Scheiner, Jesuit physicist
**QUOTE:** "It has always seemed to me unfitting ... that on the most lucid body of the Sun there are spots ... I would judge that they are not true spots but rather bodies partially eclipsing the Sun from us and are therefore stars."

ILLUSTRATIONS BY BILL REBHOLZ (GALACTIC GUESSES) RYAN NZANA (MOON)




# The Plan to Nuke the Moon

When the Soviet Union started winning the space race, the U.S. threw the galaxy's biggest hissy fit.

**AFTER THE USSR** launched the satellite *Sputnik 1* in 1957, the U.S. military panicked. It was clear America was losing the space race. To regain the lead, the Air Force Special Weapons Force came up with a strategy: Figure out how to nuke the moon.

The top secret mission, known as Project A119, was assigned to the Armour Research Foundation in Chicago. "Whether the project was motivated by a desire for the United States to impress the world (and the Soviet Union in particular), or by fear that the Soviet Union itself might try the stunt, I cannot say," recalled the project leader, Leonard Reiffel, in *Nature*. Regardless, the military wanted to flex its muscle. A team of about 10 scientists (including a young Carl Sagan) was assembled to determine if a bomb could travel 238,000 miles, hit the moon, and flash so brightly that earthlings could see it.

The team calculated the risk of moonquakes and the possibility that hunks of moon rock would blot out the sun, causing a nuclear winter. Sagan built a mathematical model to test if humans would be able to see the hypothetical mushroom cloud. (They would.) Thankfully, the mission never left the planet. It didn't help that Sagan, still a graduate student, blew the government's cover when, in 1959, he listed the classified project on his application for a fellowship. (Hey, at least he got it!)

**FAST FACT**

Russian cosmonauts packed a shotgun in case they landed in Siberia and had to fend off bears.

# Reclaiming the Sky

The skyscraper was in decline. Then Fazlur Khan had an idea that would turn architecture on its head.

BY NICK GREENE

The elevator ride from the bottom of the John Hancock Center to its 95th floor takes just 40 seconds.

LEFT BRAIN / RIGHT BRAIN

**IN DECEMBER 1965,** the psychic Jeane Dixon made a prediction: Chicago's John Hancock Center would come tumbling down. The astrologer and syndicated columnist had risen to fame after predicting the assassination of John F. Kennedy, and now she foresaw the demise of the Windy City's newest, and soon-to-be tallest, skyscraper—before construction had even begun.

When Dixon spoke out, crews had just broken ground on a plot of land north of Chicago's main business district. Those involved may not have admitted it, but the prediction likely made them nervous—and not just because of Dixon's track record. The 100-story building was to become the second-tallest structure in the world, and its radical design was unprecedented.

Structural engineer Fazlur Rahman Khan, the man behind that design, was only 35 years old when he submitted his plans. He had worked at the Chicago architectural firm Skidmore, Owings & Merrill (SOM) for just a decade. For the architecture world, he was remarkably young. But if he was wet behind the ears, he didn't show it.

Khan's easygoing nature was legendary among his colleagues. And he had his own read on the future. At

upper-crust Chicago parties, he'd entertain high-society women by reading palms and telling fortunes, a trick he'd learned as a boy growing up in Dhaka, Bangladesh. Khan was unmoved by Dixon's prediction. A tumbling John Hancock Center would end his career, but he had worked hard to prove the integrity of his design, and no newspaper astrologer could convince him otherwise.

Then, one day in March 1966, he received a phone call: His skyscraper was sinking.

**FAZLUR KHAN SEEMED** an unlikely candidate for engineering stardom. The tallest structure in his hometown of Dhaka was fewer than three stories high. He didn't see his first skyscraper in person until he was 21 years old. In fact, he likely had never even stepped inside a mid-rise building until he moved to the United States to study structural engineering at graduate school. But Khan, the son of a mathematician, proved to be a civil engineering wunderkind. He received two master's degrees in just three years.

At the University of Illinois, he studied under Hardy Cross, a legendary engineer who taught Kahn not to see buildings as concrete monoliths, but as living things. Cross had a mantra: "You must learn to think as the structure thinks." Many ridiculed Cross's ideas, writes Khan's daughter, Yasmin, in her book *Engineering Architecture*, but Khan took the advice to heart.

"I put myself in the place of a whole building, feeling every part," Khan said in an interview with *Engineering News-Record*. "In my mind I visualize the stresses and twisting a building undergoes."

Khan preached "structural empathy," believing that buildings should absorb stress and react accordingly. If someone pushes you in the chest, your ribs alone don't prevent you from falling—your stomach clenches, your calves brace, and your heels dig into the ground. The pieces work in tandem. The same went for skyscrapers.

When Khan and his friend and design partner, architect Bruce Graham, sat down to design the Hancock Center, the architectural world was in the midst of a break from skyscrapers. "Conventional" skyscrapers like the Empire State Building had proven prohibitively expensive. The higher a building, the more weight is exerted from the top. The building must also withstand winds, and these forces—downward and lateral—turn skyscraper construction into a riddle. A lot of steel and concrete is needed to keep a super-tall building standing, and all that material shrinks usable open space, riddling floors with dark, labyrinthine corridors. If you don't have floor space to sell, what's the point of making a building tall?

Khan had a solution. A few years earlier, Graham had asked him what the most economical building would look like. Khan replied, "A tube." Like the bamboo that sprouted around Dhaka, a hollow tube lent a high-rise vertical durability.

"We were like one architect-engineer," said design partner Bruce Graham, right, with Khan, above. "The purity of his thinking was what I fell in love with."

Graham and Khan put the theory into practice while constructing Chicago's 42-story Dewitt-Chestnut Apartments. The building was supported not by an inner grid of concrete and steel, but by its facade. Structurally, it had more in common with a grain silo than a traditional skyscraper—but it worked. The duo now had the blueprint for pursuing more ambitious structures.

Indeed, Khan's plans for the John Hancock Center used the same tubular design to an extreme. But to achieve heights topping 1,000 feet, it needed more support. Rather than fill the interior with columns—and retreat back to the thinking of Stone Age architects—he applied a theory he had cooked up with one of his students at the Illinois Institute of Technology. The student, Mikio Sasaki, wondered how to build a tall, cost-effective tubular building. The solution? Reinforce the facade with large *x*'s.

"It became a proven new structural concept waiting to be tested on a real building," Khan wrote. "John Hancock Center offered that opportunity."

**ELEGANT AND ECONOMICAL,** Khan's design for the John Hancock Center was supposed to usher in a new generation of skyscrapers. But when it came time to hoist thousands of tons of steel up into the sky, his employer got cold feet. To dispel any doubt, Khan brought in something new to his team at SOM: computer models. Two young programming experts calculated the equations in record time. (Soon after, they left SOM to work on *Star Wars*.)

Unconvinced by newfangled computers, SOM's brass insisted on asking outside experts to determine the safety and feasibility of the project. When one recommended a different design—and that it be overseen by a new team—an infuriated Khan issued an ultimatum: Either they let

PREVIOUS PAGE: ALAMY; THIS PAGE: KSS PHOTOGRAPHS; COURTESY SOM

him proceed, or he'd leave the firm.

Khan also needed to soothe investors, who were worried about wind. The building was designed to be pliant, and Khan's models showed that the skyscraper was 25 percent stronger than what Chicago's wind code required. But he needed to prove that gusts would be imperceptible on the building's top floors.

One Sunday afternoon, Khan took his family to Chicago's Museum of Science and Industry. There, at a washing machine exhibit sponsored by Maytag, he and his daughter stood on a rotating platform designed to mimic the oscillating motion of a washing machine. When the tub rumbled to life, his daughter flinched—and Khan had an epiphany. He persuaded the museum to let him use the exhibit to stage a motion perception test, asking eight volunteers to stand, sit, or lie down at the base of the empty tub. As the motor rotated the floor, everyone tallied their perceptions of movement. Using that data, Khan ensured the Hancock's sway would fit into the comfort zone. Shortly after, he got the OK to build.

**CHICAGO IS NOT** an easy place to build skyscrapers. Unlike New York City, with its easy-to-reach bedrock, Chicago is swamp and sand. For centuries, it was difficult to *walk* there. That's why Chicago built 561 miles of wooden sidewalks in the 19th century—which became the 561 miles of kindling that fueled the Great Chicago Fire of 1871.

None of that stopped the engineers rebuilding Chicago from reaching for new heights. In 1885, they completed the 138-foot-tall Home Insurance Building, the world's first modern skyscraper. Other steel Goliaths followed. An 1891 *New York Times* article offered begrudging but skeptical praise about the towers sprouting from the "slimy ooze," asking, "Who shall restrain the great layer of jelly in Chicago's cake?"

If Chicago was built on swamp, the site of the John Hancock Center was soup. The area was water until the city dumped ash and debris from the Great Fire there as landfill. In 1886, an eccentric con artist named George Wellington Streeter claimed the land after running his steamboat ashore. (Constables tried to evict him, but Streeter fired buckshot whenever they approached.) The area, now called Streeterville, is home to the deepest bedrock in Chicago. Khan was building right on top of it.

Khan's design called for 57 caissons—8-foot-thick concrete columns—to be plunged into the bedrock to support the building's 46,000-ton steel frame. One of those caissons had to be extended up to 197 feet below the surface, then a world record. But soon after the caissons were put in place, Khan received bad news from his field man at the site: One of the caissons had shifted seven-eighths of an inch: The base of the $100,000,000 building was sinking. Khan immediately called a meeting at the building site, looked at the concrete pillars, and cleared his head.

Khan always had a knack for identifying invisible problems. In Mir M. Ali's *Art of the Skyscraper*, a friend of Khan's relays a story about having lunch with him at engineering college in Calcutta. After the food was served, the friend was about to dive in when Khan asked the waiter to change his plate. "There is a hairline crack in your plate where bacteria may grow," he explained. The waiter whisked the dish away.

Looking over the Hancock's groundwork, Khan knew the design wasn't at fault. It had to be the caissons. He ordered sonic tests to find weak spots and found that the contractors, in an effort to save time and money, had poured concrete while the drills were in place. When they pulled the machinery out, the concrete was still setting. Chicago's soil had seeped into the gaps, causing the shift.

Crews had to check all the caissons, setting the project back six months. After it was deemed safe, Khan made sure the 100-story building was finished on time—and it only cost as much as a conventional 45-story building. Suddenly, skyscrapers made financial sense again.

**FOUR YEARS LATER,** Khan finished the 108-story Sears Tower (now called Willis). But by then, the Hancock had stolen Chicago's heart. "Dark, strong, powerful, maybe even a little threatening—like a muscle-bound, Prohibition-era gangster clad in a tuxedo—the John Hancock Center says 'Chicago' as inimitably as the sunburstlike summit of the Chrysler Building evokes the jazzy theatricality of New York," wrote architecture critic Blair Kamin.

There were only minor quibbles about the wind. Employees at the restaurant on the 95th floor noted that bottles in the wine rack clanked. (They moved the wine to the basement, to be fetched via express elevator.) When one woman was upset her chandelier swayed on breezy days, Khan reinforced the fixture himself.

One day, Khan was sitting in the Hancock's open-air plaza when two women began admiring the building. As his daughter writes, Khan couldn't help but eavesdrop. "'The diagonals,' one woman explained, 'were placed on the facade with artistic intent by the architect.'" Khan was flattered: His design was so elegant, it could only be explained as an artistic addition.

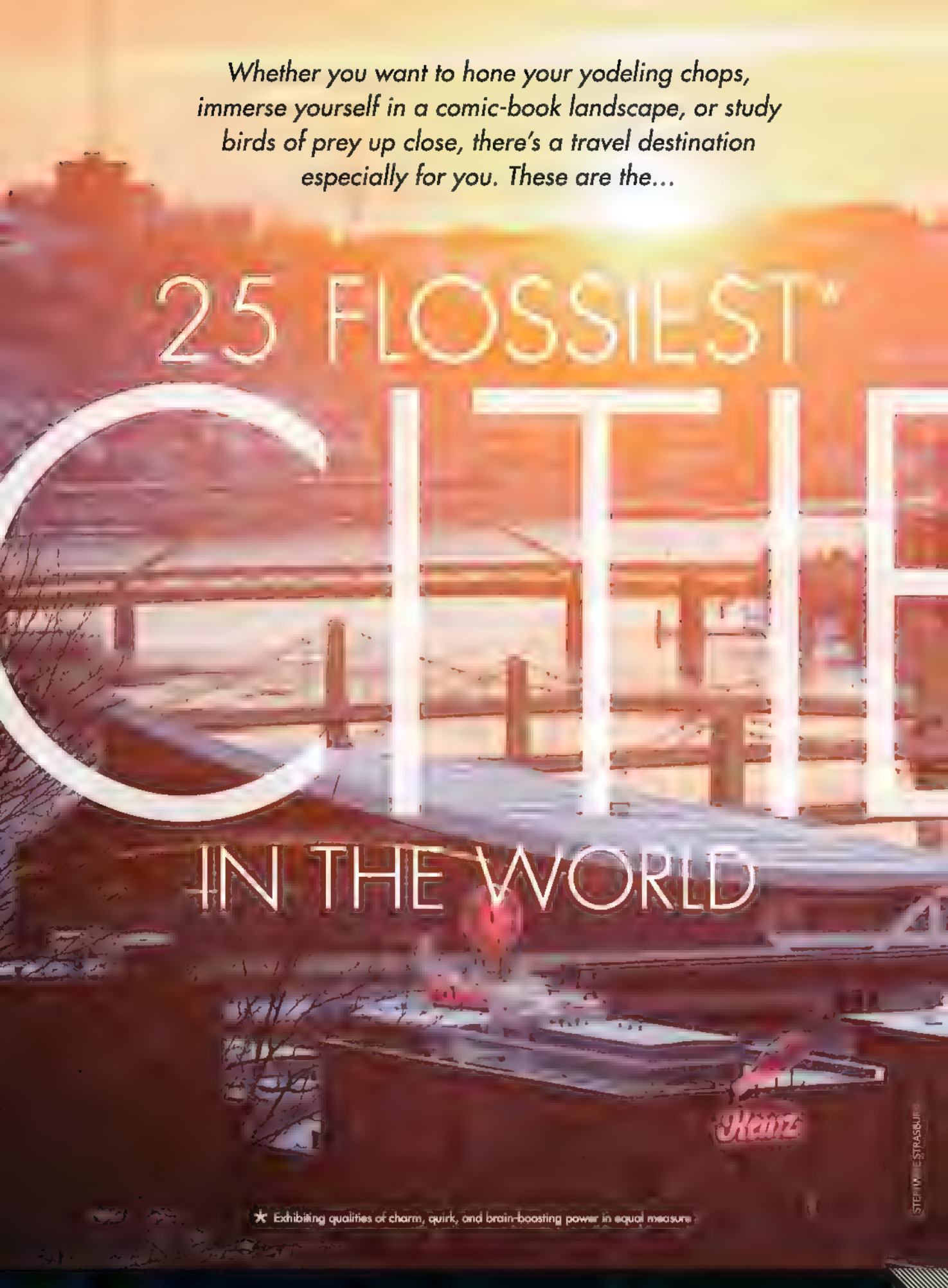
**THE HANCOCK WAS A MUSCLE-BOUND, PROHIBITION-ERA GANGSTER CLAD IN A TUXEDO.**

Upon its completion in 1969, the John Hancock Center was the second-tallest building in the world. Today, it's the 41st. Every skyscraper ahead of it on the list of the world's tallest buildings (with the exception of the Empire State Building) is a descendant of Khan's design. Thanks to the clever structural engineer, who knew that strength comes from flexibility, the skyscraper shed its status as a relic. Today, it is how a city reinvents itself. A growing skyline is a reminder that we will never stop reaching for greater heights.

In 1982, Khan died of a heart attack in Jeddah, Saudi Arabia. Today, construction is underway there on the Jeddah Tower, a skyscraper that, upon its completion in 2020, will become the world's tallest: 3,307 feet high. Its "buttressed core" evolved from Khan's tubes. The innovation earned William F. Baker, the engineer behind the concept, one of architecture's highest honors: the Fazlur Khan Lifetime Achievement Medal. ®

*Whether you want to hone your yodeling chops, immerse yourself in a comic-book landscape, or study birds of prey up close, there's a travel destination especially for you. These are the...*

# 25 FLOSSIEST™ CITIES IN THE WORLD




★ Exhibiting qualities of charm, quirk, and brain-boosting power in equal measure

1

Pittsburgh, Pennsylvania

BEST CITY FOR

## Futurists Who Crave French Fries

Where can you practice telekinesis, play soccer on a grain of rice, and duel a trash-talking robot in a game of Scrabble—all while eating a meaty sandwich covered in fries?[1] Pittsburgh, Pennsylvania, of course.

The vision of Pittsburgh as just a cauldron of smokestacks and steel mills is a thing of the past. In fact, few cities are as firmly planted in the future. Like a Silicon Valley of the East, Pittsburgh is a robot paradise, home to more than 60 robotics companies, the National Robotics Engineering Center, and the Robotics Institute—the largest robotics research organization in the world. As daily life becomes more automated, it's companies here driving the change.

The Steel City isn't just good for tech jobs; it's a ringside seat for watching *The Jetsons* become reality. Carnegie Mellon University has built driverless cars (it's one of Google's few competitors). The University of Pittsburgh created a robotic arm for a quadriplegic woman—controlled by her *thoughts*. The city even hosted the RoboCup Open, where nanobots played soccer on a microscopic field. Let the rest of the world have their World Cup. We'll take front-row seats to cheer on an invisible robo-Ronaldo any day. –LUCAS REILLY

Fun fact: Pittsburghers also put fries on salads. (Coincidentally, the city is the Heinz headquarters.)

**Roboworld,** the world's biggest robotics exhibit, where you can check out the Robot Hall of Fame and challenge a 'bot to some air hockey *Carnegiesciencecenter.org*

**Fraley's Robot Repair,** a public art installation by Toby Atticus Fraley, designed to resemble a futuristic robo-doctor's repair business. It's a local favorite *Pittrobotrepair.com*

A: AMY

EAT at **Conflict Kitchen**, which features cuisine from nations with which the U.S. is in conflict (currently Iranian food). One day, it may serve fare loved by our robot overlords. *Conflictkitchen.org*

# *Reroute Your Trip!*

# 7 Places to Go Off the Beaten Path

**2 Instead of Venice, visit Giethoorn, Netherlands.** "Holland's Venice" looks straight out of a fairy tale. With no roads or cars, visitors get around exclusively by foot, bike, or boat. Four miles of canals, dug in the 13th century to help transport peat, bend by thatched-roof homes and under quaint wooden footbridges. And in the winter, locals traverse the canals on ice skates.

**3 Instead of Pisa, visit Lavenham, England.** A walk down the streets of Lavenham can feel a bit off. Many of its buildings, built in the 15th and 16th century, are crooked. That's because medieval construction workers used green (i.e., moist) timber, which caused the homes to warp as they aged.

**4 Instead of Austria, visit Huizhou, China.** In an effort to ease Shanghai's growing population, officials in China's largest city kicked off a project in 2001 called "One City, Nine Towns." The idea? Build carbon copies of European cities within Shanghai's limits. Most of the projects ended in failure, but not before sparking a "duplicature" craze countrywide. China has since built Austrian, English, Swiss, Italian, and Spanish copycat cities. You can visit a lovely replica of Hallstatt, Austria, in Huizhou.

**5 Instead of Roswell, New Mexico, visit Varginha, Brazil.** The truth is out there—like, in Brazil. In January 1996, a UFO was reportedly sighted crashing near the city of Varginha. A pair of sisters reportedly spotted an alien moseying down the streets, and rumors spread that the military captured the critter. Ever since, residents have embraced their little green visitors. (One local water tower is shaped like a UFO.)

**6 Instead of the Four Corners Monument, visit Kazungula, Botswana.** Kazungula offers a unique attraction: It's the only place on Earth where four countries meet. In the middle of the Zambezi River, Namibia, Zambia, Zimbabwe, and Botswana all collide. If looking at imaginary lines from the shore doesn't excite you, you can cross them by ferry.

**7 Instead of Gas Town from *Mad Max*, visit Neft Daşlari, Azerbaijan.** We realize this fictional apocalyptic landscape isn't actually on your list. But if you dream of seeing something like it, here you go. Patched together from floating oil tankers and crumbling Soviet platform blocks, Neft Daşari sits over the Caspian Sea. The network of oil rigs and homes is connected by bridges and pipelines sitting on the backs of sunken ships—basically, the USSR's dystopian version of an oil-rich Atlantis.

**8 Instead of New York City, visit Shibam, Yemen.** Nicknamed "the Manhattan of the Desert," Shibam is a grid of 500-year-old skyscrapers—made of *mud*. Sitting on an ancient spice route, the mud brick towers were built after a terrible flood in the 1530s. Some reach heights of 11 stories. Recognized by UNESCO as a World Heritage Site, Shibam is home to about 7,000 people.

***BEST CITY FOR***

# DEMOCRACY-LOVING YODELERS

**9**
**Appenzell, Switzerland**

If American electoral politics are making you antsy, lower your blood pressure with a visit to Switzerland. The canton, or member state, of Appenzell Innerrhoden boasts quiet pastures, snow-capped mountains, buildings that look like gingerbread houses, and one of the oldest direct democracies in the world.

Since the 13th century, Appenzell's citizens have gathered in the village square for *Landsgemeinde,* a public open-air vote (2012's is pictured here). Anyone can take to the stage to speak, and there's no secret ballot. Elections and rulings are made by a show of hands. Bonus: Nobody has to worry about hanging chads.

But democracy is far from Appenzell's only attraction. It's also a central haunt for yodelers. Records from 1545 describe the practice as "the call of the cowherd Appenzell." And if music and freedom aren't alluring enough, consider that the region is also home to the Champagne of cheeses, crafted with a special 700-year-old cheesemaking process that uses a secret herbal brine that can be made only in Appenzell. –MELISSA LYNN MATTHEWS

ALAMY, YODELING; GETTY, CROWD

**LEARN**
to yodel by scheduling a lesson with the pros at the local tourism board. While you're at it, try your hand at ***Talerschwingen,*** a traditional form of music that requires only a coin and a bowl. *Appenzell.ch*

**CELEBRATE**
all things bovine during the ceremony of **Alpabfahrt,** which marks the return of cattle from the mountains. Locals sing as a cow parade—cowbells clanging—ambles into town. *Every Sept. or Oct.*

Another reason to raise your hand in the air like you care: Every three years, Switzerland hosts the International Yodeling Festival. Book your ticket now. The next competition is this September

*BEST CITY FOR*

# Magicians in the Making

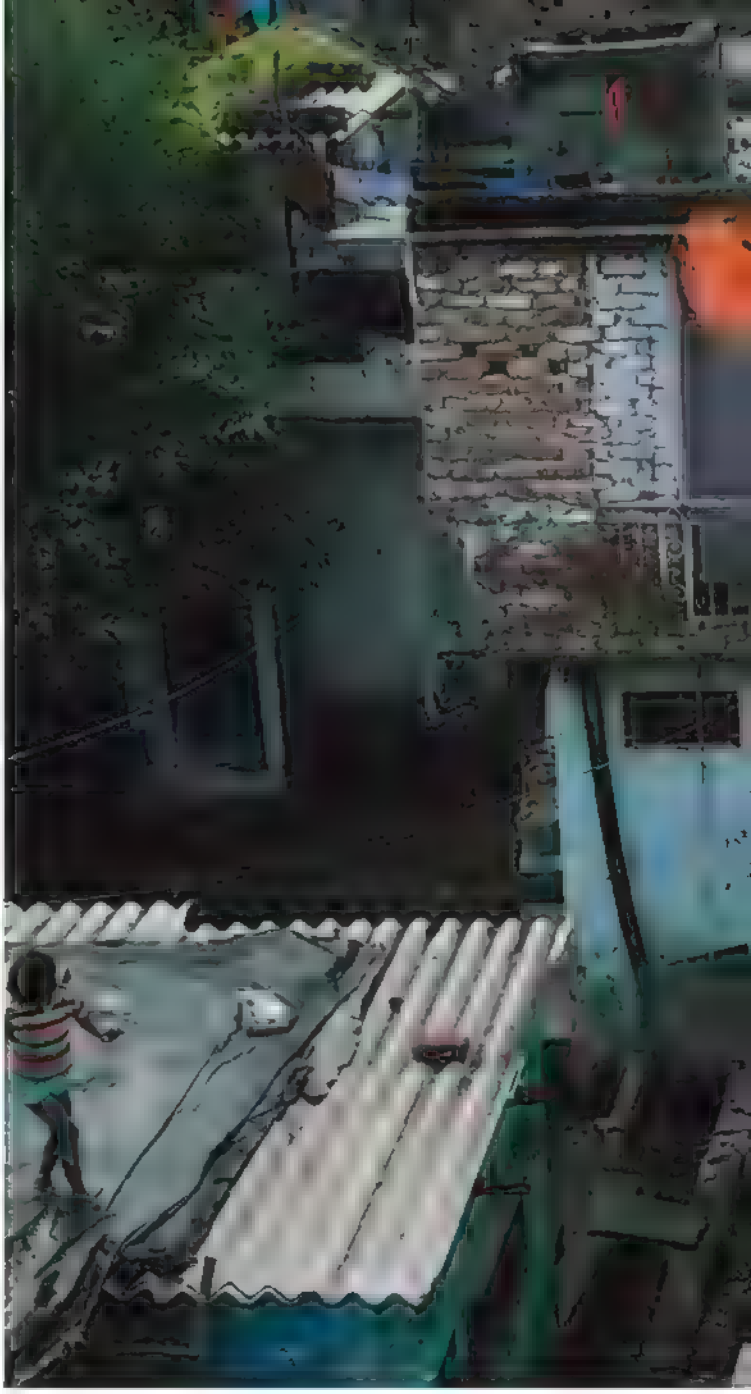
**10**
**New Delhi, India**

For centuries, magicians, puppeteers, acrobats, dancers, snake charmers, and jugglers filled the streets of New Delhi, performing routines passed down over generations. In the 1950s, many of these performers moved to a slum in South Delhi called Kathputli Colony. At its height, nearly 2,800 artist families lived there, making it the biggest collection of street performers in the world.

Today, the numbers have dwindled. Over the past five years, redevelopment has forced hundreds of these families with performing lineages (known as "tribes") to relocate. Now, Delhi plans to build its first skyscraper in the area, which is causing the collective of street artists to disintegrate.

The redevelopment is only one obstacle. Local laws classify the street performers as beggars, and they must defy police to put on shows. But many are hoping they can take back the streets. International magicians such as Ishamuddin Khan—an expert at ancient Indian illusions—are lobbying the local government to designate public performing spaces for the artists, while NGOs, including the Kalakar Trust, are trying to improve the performers' living conditions.

In the meantime, talented acts still exist. You just have to know where to look, says Delhi-focused travel agent Allison Sodha. While some sanitized acts perform in theaters, travelers who wander the winding alleys near the markets of Old Delhi can still catch a glimpse of the magic before it disappears. –CORINNE IOZZIO



# 6 Must-See Cities for Idiom (AND PROVERB!) Connoisseurs

**11 "DO YOU LIVE UNDER A ROCK?"** For the residents of **Setenil de las Bodegas, Spain**, the answer is "Why, yes." The town is rooted in a river gorge and sprinkled with whitewashed homes and earthy terra-cotta roofs. Some, however, are earthier than others. One part of town, built into mountain caves, has turned a large rock overhang into a readymade roof.

**12 "YOUR HEAD IS IN THE CLOUDS."** If anyone has ever said this about you, put **El Alto, Bolivia**, on your bucket list. Nearly three times as high as Denver (well, in elevation, at least), the city of one million sits at 13,650 feet—which is like dropping San Jose, California, on top of the Grand Tetons. It's so high up, residents can use cable cars to visit neighboring La Paz, 1,200 feet below.

**13 TRAVEL "BY THE BOOK."** The Romanian city of **Cluj-Napoca** proves that books truly can take you anywhere. To celebrate literature last June, it declared that anyone who hopped on a public bus with a book (and presumably, read it) would get to ride for free. Phones and e-readers didn't count—riders had to carry a physical copy to earn their free fare.

The Kathputli Colony was settled in the 1950s by a group of roving puppeteers. (*Kathputli* is the name of a centuries-old form of Indian string puppet theater.)

**VISIT**
**St+Art Delhi,** an annual festival that invites international artists to transform the blank or graffitied walls of Delhi villages into sweeping murals. It's a great way to see diverse displays of art all in one place *St-artindia.org*

**WATCH**
**Kushti mud wrestling,** a 3,000-year-old Indian martial art with hints of yoga and sumo. Wrestlers train outdoors in the northern end of the original walled city *By the Kashmere Gate, Old Delhi*

**SHOP**
every Sunday at the **Kitab Bazaar,** a book market where bibliophiles can rummage through nearly a mile of titles of all genres and languages. Keep an eye out for first editions! *Daryaganj, Old Delhi*

**14 "EVERY CLOUD HAS A SILVER LINING."** The old proverb rings especially true in **Los Angeles, California.** Racked by a historic drought, the county has turned to cloud seeding techniques to coax extra drops of rainfall. The process involves diffusing common chemicals into the atmosphere to produce moisture. This March, as an El Niño weather system passed over L.A., officials seeded clouds with silver iodide—a fitting silver lining glimmering over Tinseltown.

**15 "EMBRACE THE WILD GOOSE CHASE."** Nestled on Baffin Island, **Iqaluit** is the capital of the Canadian territory of Nunavut. It's also the closest "big" city to the Dewey Soper Migratory Bird Sanctuary, which is home to about 30 percent of Canada's breeding geese, making it the planet's largest goose sanctuary. If you ever wanted to go on a literal goose chase, there's no better place. Not that we endorse the idea—geese can be vicious! (For a safer flight of fancy, see page 33.)

**16 "WHEN HELL FREEZES OVER."** A cold day in hell isn't as rare as people say. In January, the average temperature in **Hell, Michigan,** is a balmy 17°F. The town, just miles from Ann Arbor, supposedly got its name in the 1830s. (As one story goes, when local men visited a nearby moonshiner, their wives would lament that their spouses had "gone to hell.") There you can get a diploma from "Damn U" at the local gift shop and even pay $100 to become the official "Mayor of Hell" for a day.

ALAMY

BEST CITY FOR

# PEOPLE WHO REALLY LOVE BLUE

**17**
**Chefchaouen, Morocco**

Morocco's cities are kaleidoscopes of color. Tangier is prized for its whitewashed architecture, while Marrakech is nicknamed "The Red City." In Meknès, dazzling terra-cotta mosaics, called *zellige,* are everywhere. Meanwhile, in Fez, bags of powdered pigment—greens, purples, and oranges—appear to lean against the walls of every alleyway. Few places, however, hold a candle to Morocco's "Blue Pearl": Chefchaouen.

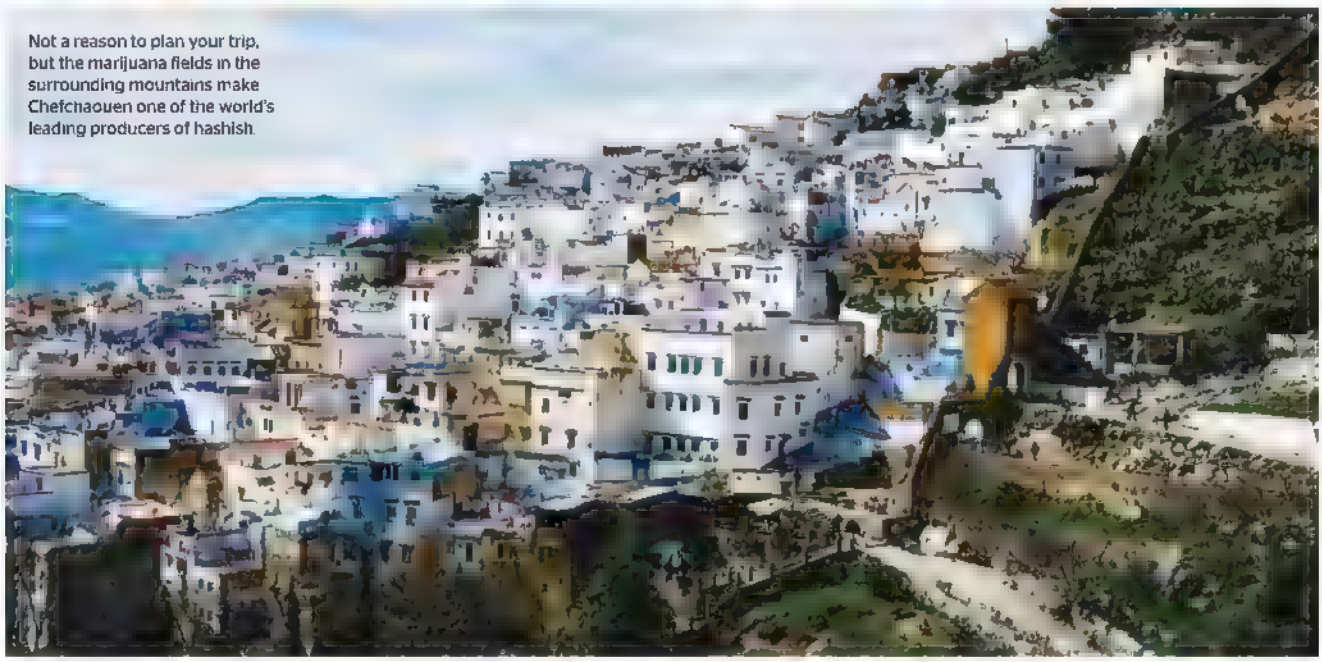
Nestled in Africa's northern Rif mountains, Chefchaouen has a history of attracting outcasts and exiles. During the Spanish Inquisition, Muslims and Sephardic Jews took refuge there. For centuries, Chefchaouen walled itself off to visitors. (The city was so insulated that when Europeans snuck into it during the 1800s, they reportedly discovered that some of its citizens still spoke an otherwise forgotten 15th-century Spanish dialect.)

Then, during the 1930s, Chefchaouen opened its doors once again, this time to Jewish refugees fleeing Europe. The transplants quickly made themselves at home by painting the town blue—every shade of it, from turquoise to cerulean to eggshell. The practice was a shout-out to *tekhelet,* a sacred bluish dye worn by ancient royal Israelites. And, depending on whom you ask, the blue was also intended to echo the sky, a constant reminder to the city's inhabitants of their God above. The tradition caught on. Now, every two years, residents slap a new coat of blue paint onto Chefchaouen's lower walls—evidence that there is some comfort to be found in having the blues.

—ERIN BLAKEMORE

**SCRUB**
with the locals at **Douches Barakat**, a hammam (or public bath). Be sure to pick up some soaps from the market before you go. But don't strip down to the nude—it's a faux pas.
*Rue Ibn Asskar*

**KEEP SCRUBBING**
at **Ras el-Maa**, a small waterfall outside the medina where locals wash their clothes. It's a peaceful place to face the cold reality of traveling: needing to do laundry.
*Av. Ras Elma*



Not a reason to plan your trip, but the marijuana fields in the surrounding mountains make Chefchaouen one of the world's leading producers of hashish.

ALAMY

# Where to go if you love...

**18 ... CHESS (AND BUDDHISM)** Kirsan Ilyumzhinov is an astrology-loving Buddhist millionaire who claims he was abducted by aliens. But Ilyumzhinov the former president of the Russian Republic of Kalmykia, also worships chess. In 1998, he dropped $50 million to build a complex in **Elista, Russia**, for the Chess Olympiad. The "Chess City" has hosted numerous international competitions. Unrelated: Elista is home to Europe's largest Buddhist population—plus the world's biggest plastic Buddha!

**19 ... LINGUISTICS** More languages are spoken in Papua New Guinea—approximately 800—than anywhere else. While **Port Moresby** the country's capital, may not be the safest place to visit, it's a must for language geeks to know about: It's one of the most linguistically diverse places on the planet. If you selected two random neighbors, they'd likely have different mother tongues.

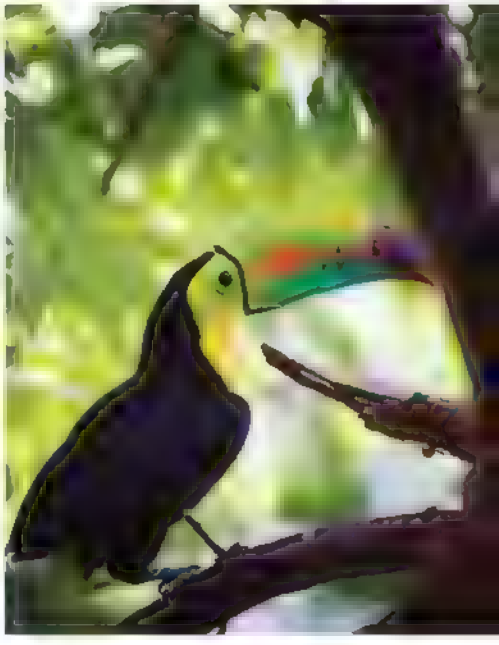
**20 ... COMIC BOOKS** Comics are so revered in France, they're called "the ninth art." In **Angoulême**, streets are peppered with murals by comic book artists, and street names are contained in speech bubbles on signs. The local comic book museum houses more than 110,000 comic books and 8,000 original drawings. Every January, the city hosts the world's second-largest comic book festival.

**21 ... THE CIRCUS** For decades, carnies, roustabouts, clowns, acrobats, and other sideshow performers came to **Gibsonton, Florida**, to relax during the wintry off-season. Special zoning laws in "Showtown, U.S.A." allowed residents to keep circus trailers, carnival rides, and even elephants on their lawns. Talking point: In the 1950s, the town's police chief was a dwarf and the fire chief was a giant.

**22 ... POLITICAL REVOLUTION (AND DINOSAURS)** In 1809, rebels in **Sucre, Bolivia**, sparked the Bolivian War of Independence by ringing a church bell until it cracked. (Sorry, Philly, you don't have a monopoly on liberty bells.) Equally rich in natural history, Sucre sits by a limestone cliff covered by 5,000 Cretaceous dinosaur footprints. Last year, more were discovered nearby, bringing the count to 10,000 (nearly 10 times more than the world's second-largest collection of tracks, in Colorado).

**23 ... BATMAN** In 2008, the mayor of **Batman, Turkey** claimed he would sue Warner Bros. and Christopher Nolan for appropriating the city's name. "There is only one Batman in the world," Huseyin Kalkan said. (In ancient Persia, a "batman" was just a unit of weight, close to 17 pounds.) But it didn't work, because the city only adopted the name in 1957, nearly two decades after the first Batman comic appeared.

**24 ... BOOKS** The branched-off of a group of publishers, **Paju Book City, South Korea**, is home to more than 200 publishing companies. Aside from publishing offices and printers, the city is staffed with art galleries, cafés, and used bookstores. Introverts, rejoice! It's estimated that books outnumber people there by a ratio of 20 to 1.



ALAMY

BEST CITY FOR

# Bird Nerds

**25**
**Panama City, Panama**

A stew of historic ruins, colonial architecture, and modern glassy towers, Panama City is the most cosmopolitan town in Latin America. But that's not all. If Alfred Hitchcock's ghost ever decided to stage a tropical reboot of *The Birds*, he'd choose to film it here.

That's because the city serves as a major waypoint for migrating raptors: Twice a year, millions of birds of prey pass through town. On a regular day, residential parks overflow with colorful parrots, parakeets, woodpeckers, and toucans. Metropolitan Natural Park is the city's crown jewel, says Panama Audubon Society director Rosabel Miró. The world's only protected tropical forest within major city limits, the 573-acre gem contains more than 250 species of bird. It's enough to make the most experienced twitcher salivate.

But there's more. The mecca of birding destinations—Pipeline Road, in Soberanía National Park—is just a short drive outside the city limits. In 1985, the Audubon Society traveled the path and identified 385 different bird species in 24 hours. That's a different species spotted every four minutes!

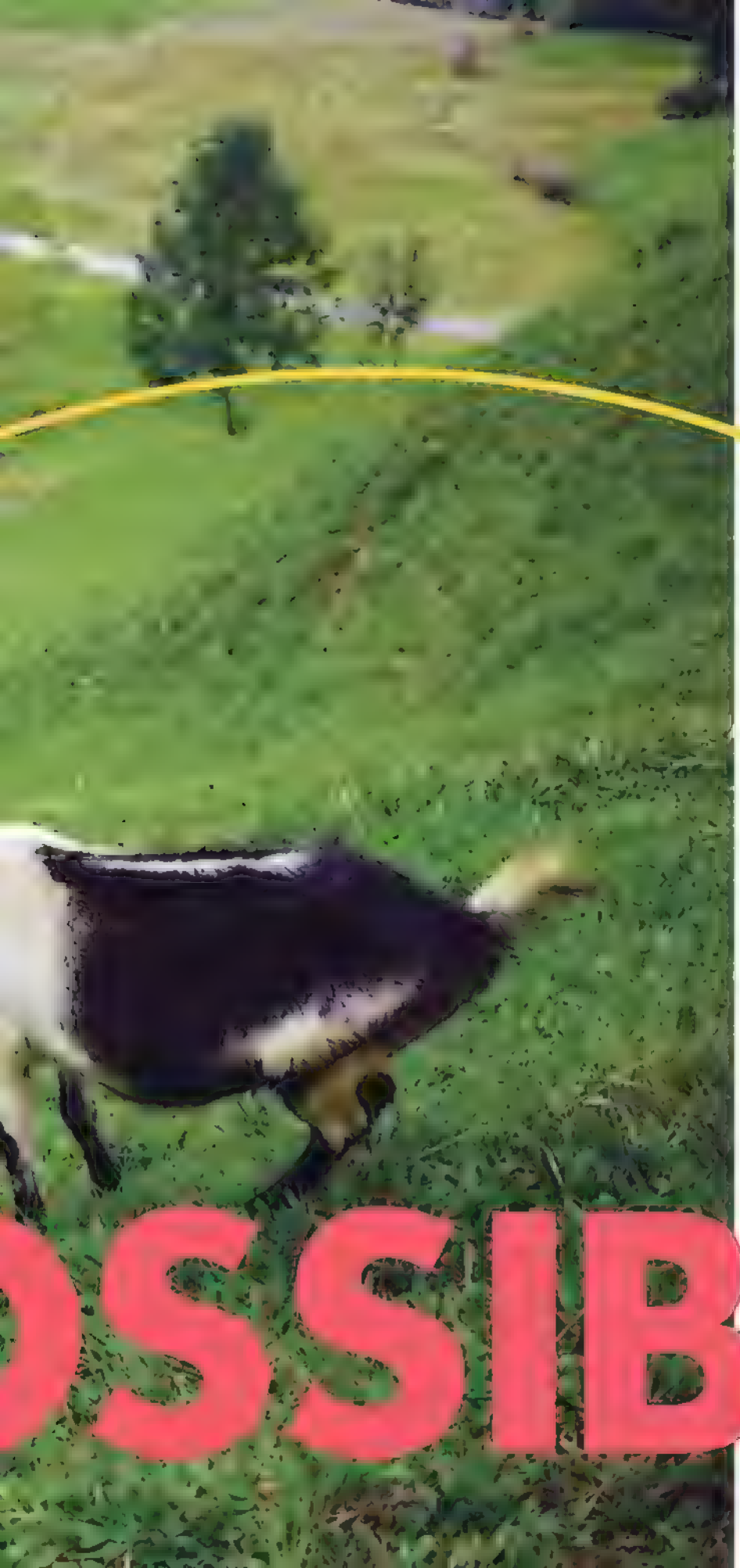
—CORINNE IOZZIO

**VISIT**
**BioMuseo,** a Frank Gehry-designed museum dedicated to biodiversity. It boasts eight exhibitions, including one on historic and migrations. *Biomuseopanama.org*

**STAY**
at **Canopy Tower,** a hotel in Soberanía National Park with rooms feet from the canopy, making you level with your winged neighbors. *Canopytower.com*

**SHOP**
for molas and textiles at **Mercado Nacional de Artesanías.** The fabrics, a specialty of Kuna Indians, originally contained intricate, geometric patterns, but artists later drew inspiration from local wildlife—like birds! *Av. 6 Sur, Panama Viejo*

mental_floss presents
DO THE
IMPO



BY **LUCAS REILLY**
PHOTOGRAPHY BY **TIM BOWDITCH**

# Be like this guy and become a goat!

Wouldn't life be simpler if you could trade places with an animal? British designer and author Thomas Thwaites thought so. Then he actually tried. Now he explains the how—and why.

OSSIBLE

**What compelled you to become a goat?** I think it was an attempt at self-help. There's a need to acknowledge your animal side, to counteract the mad human side. I wanted to see how close technology could take us to adopting the characteristics of other animals. Every child's dream is to experience the world from a different point of view. Name an animal, and it would be brilliant to be it for a week.

**At first, you wanted to be an elephant.** This started as a design project.[1] I was going to make this huge exoskeleton. I thought it'd be easier to be bigger, but I visited a shaman, and it became clear that the project wasn't just about designing a cool exoskeleton.

**You visited a shaman?** Right. Taking the shamanic approach, there's an innate sense that we're similar to other animals. Humans aren't necessarily superior or separate. And in shamanism, the whole reason anybody can "transform" into an animal is because you've grown up together. The shaman asked, "Where are you going to get an elephant in the U.K.?" Goats, on the other hand, are everywhere.

**So physically, what did the process entail?** I had a vague idea: a big powerful exoskeleton with loads of springs and elastic bands. But all of those mechanical joints did not work. That prototype flopped. For the second prototype, I tried to mock up a Paralympic design, with springy legs. I was fine walking up and down in my flat, but it would have never stood up to a trek in the Alps.

**IT BECAME CLEAR THAT THE PROJECT WASN'T JUST ABOUT DESIGNING A COOL EXOSKELETON.**

**Why not?** The mechanics of the human body are so subtle. Just stepping off a curb to cross the street is an amazing feat. You don't realize how much your body is doing until you try to replicate it, making joints and hinges in a workshop. A little knowledge is a dangerous thing. I had this dream of galloping, and I had just enough knowledge to think it was possible. Turns out, becoming a goat was more difficult than I thought.

**So at this point you visited a biomechanics lab.** My grand exoskeleton had to be pared back to a more minimal design. To become a quadruped, I had a group of prosthetists mold me new limbs.

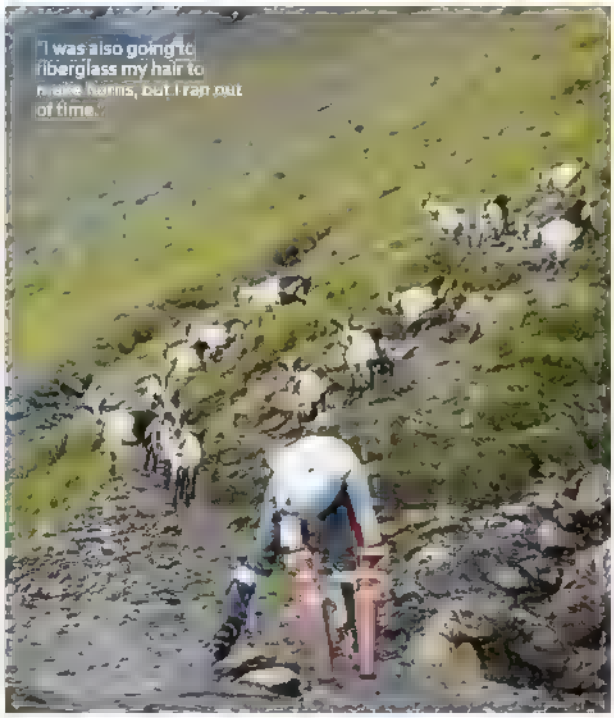
**You also visited a neuroscience lab for transcranial magnetic stimulation.**[2] Essentially, I had my brain zapped for a few seconds to disrupt its language center. That way I couldn't think about the past or future.[3] It was like when you have your face numbed at the dentist.

**And you considered an enema with goat poo?** Goats have different bacteria that help them digest their food. I thought if you can get a sample of that bacteria and transplant it inside of you, you would gain the ability to digest like a goat. After more research, I learned that goats have a rumen, an extra organ just before their stomach and intestine. So I made an artificial rumen instead and ended up eating quite a lot of grass. I did have some goat poo ready in my flat that I finally got rid of. My girlfriend was pleased to see that go.

**How was eating all that grass?** If I had eaten much

[1] The GoatMan project was funded by the global charity the Wellcome Trust
[2] In which magnetic and electrical pulses partially suppress activity in your brain.

[3] As Thwaites writes in his book, "It's this ability to mentally travel in time that makes humans such good planners and schemers, but which also allows us to worry and regret. Goats feel anxious and stressed about their present, but they don't get the same feeling about 'what might happen if' ... If you can't imagine future scenarios, you can't worry about them, and if you can't remember the events of your past, you can't regret them!"



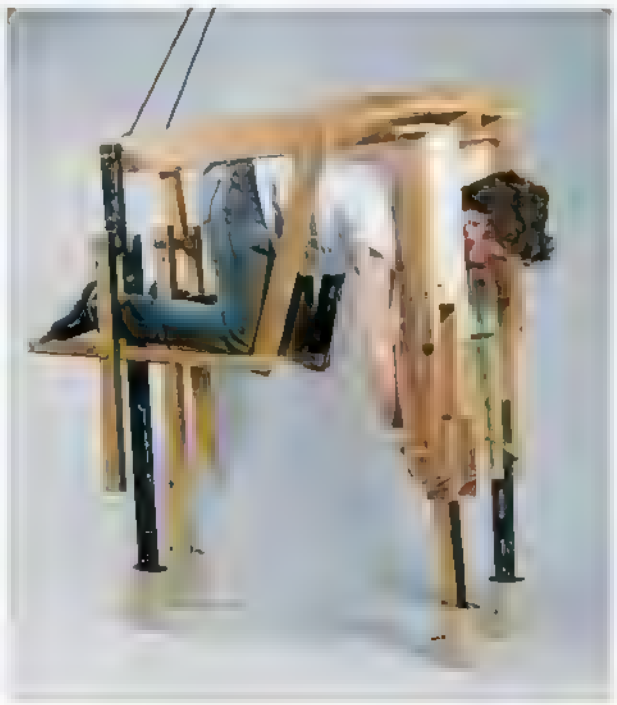



PHOTO OF THWAITES AT THE BUTTERCUPS GOAT SANCTUARY BY VERA MARIN

more, my teeth would have started to lose their enamel. I did get some gut problems, but that happens when you go on holiday somewhere exotic, anyway.

**What did you leave out of your final prosthetic design?** A nuchal ligament. It's like a cable running down the back of the neck. I wanted to build one, but the prosthetists didn't think that was a good idea, because I might not feel the damage I was inflicting on myself. Goats also have a 320-degree field of vision, so I bought a lot of prisms to adapt my vision, as if my eyes were on the side of my head. But it didn't work out.

**The next step was joining a herd, which you did for three days in Switzerland.** When a stranger moves to town, you ask, "Blah blah blah, where do you come from?" That happened, but in a goat way. A lot of sniffing.

**Did you make any goat lady friends?** One goat was sniffing my beard. Male goats—billy goats—have a beard, and that's their big, powerful "man smell" area.[4] So, um, yeah, maybe.

**Did you start feeling less human?** Momentarily, as you're chomping on grass surrounded by lots of goats, you can forget yourself. I definitely smelled of goat, and you can't help but feel more goatlike then. ❁

Thomas Thwaites's second book, *GoatMan: How I Took a Holiday From Being Human*, published by Princeton Architectural Press, is available in bookstores now.

[4]They urinate on it to woo the ladies. Thwaites, however, did not

# The Soviets Who Saved Rock 'n' Roll

## *How crafty bootleggers made music out of discarded X-rays (Eat your heart out, Pinterest!)*

BY **JAKE ROSSEN**

In the 1950s, officials in the USSR cringed at feel-good songs like "Boogie Woogie Bugle Boy." In an effort to insulate Soviet culture from western "bourgeois" influences, Joseph Stalin's regime outlawed genres like jazz, dissonant classical music, and rock 'n' roll. Predictably, blacklisting American music only made it more irresistible to Russia's youth. With vinyl records nowhere to be found, rock fans had to get creative. So they turned to radiology.

To listen to the forbidden tunes, a subculture of young music lovers—derisively called the *stilyagi*, meaning "style hunters"—secured albums from smugglers who traveled abroad. Then, they did something impossible: They built a music library from scratch. They scoured hospital dumpsters for discarded X-rays (made of a plastic that could be grooved the same way as vinyl), cut them into circles, burned holes in the middle with cigarettes, and used record engravers to crudely etch bootlegged music onto the sheets. Known as "bone music," the discs were sold on street corners, in alleys, and in parks. Dealers sized up customers (to ensure they weren't undercover cops) by peppering them with music trivia.

The quality of the one-sided records ranged from fair to barely audible, but at only a few rubles, they were worth it. Unfortunately, sellers commonly labeled records incorrectly. To some Russians, the Beatles sounded a lot like Chuck Berry.

Authorities tried to discourage what was called "music on the ribs" by slipping hoax records into circulation. When the needle touched the plastic, listeners expecting to hear Elvis instead received a scolding: "So, you want to listen to American music?" Those caught with the pressings risked reprimands and jail time.

Stalin's regime made the recordings legal in 1958, after millions of them had already been sold. But not even the threat of imprisonment could dissuade the *stilyagi*. One bootlegger, Rudy Fuchs, spent three years in jail for daring to press American sounds onto the X-rays. In fact, after hearing Bill Haley's "Rock Around the Clock," he saved up for a lathe by selling his own blood. When he got out of prison, he promptly resumed operations. Like so many of his peers, the bone music had worked its way into his marrow.

The Soviet government ordered that all hospitals get rid of their X-rays after a year. (They were a fire risk.) Music bootleggers secretly bought the scans, paying hospital staff with a few rubles or a couple of bottles of vodka.

This scheme was called the "Zhdanov Doctrine."

THE X-RAY AUDIO PROJECT ALBUM ILLUSTRATION BY ER NYFELER

(NOT SO)

# 6 Impossible Gadgets

## They were just science fiction ... until they became fact.

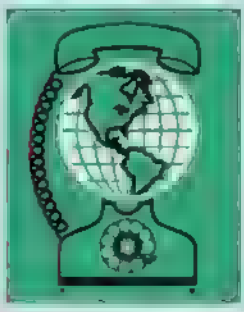
BY **KRISTY PUCHKO**

**The Science: Earbuds**
**The Fiction: *Fahrenheit 451***

When Ray Bradbury's dystopian epic appeared in 1953, headphones were clunky and still teashed to record players. Bradbury envisioned something sleeker: "And in her ears the little Seashells, the thimble radios tamped tight, and an electronic ocean of sound, of music and talk and music and talk coming in, coming in on the shore of her unsleeping mind."

**The Science: Cell phones**
**The Fiction: *Star Trek***

In a 1967 guide for *Star Trek* writers and directors, an entire section was devoted to Trekkie terminology. One entry was for *communicator*, defined as "a portable 'intercom' about the size of the hand phasers." American engineer Martin Cooper said, "That was not fantasy to us. It was an objective." In 1973, the idea helped inspire him to invent the first handheld mobile phone.



**The Science: The Internet**
**The Fiction: "From the *London Times* of 1904"**

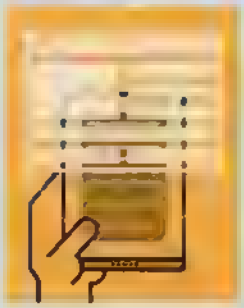
Nearly a century before the World Wide Web appeared, Mark Twain's 1898 short story pretty much predicted it: "Improved 'limitless-distance' telephone was presently introduced, and the daily doings of the globe made visible to everybody, and audibly discussable too, by witnesses separated by any number of leagues." (Yet, he failed to predict Al Gore.)

**The Science: 3-D printing**
**The Fiction: *Nick and the Glimmung***

In Philip K. Dick's only children's book, an alien named Lord Blue can copy anything it touches: "The colonists brought precious possessions up to Lord Blue, and, undulating with effort, the great old printer produced, from itself, a reproduction of the object," Dick wrote this in 1966. Little did he know, engineers would soon make it a reality.

**The Science: Tasers**
**The Fiction: *Tom Swift and His Electric Rifle***

The 1911 novel by Victor Appleton features "electric rifle bullets [that] are similar to the discharge of lightning, except that they are invisible." Decades later, aerospace scientist Jack Cover invented a stun gun and, remembering the Tom Swift books of his youth, called it "Thomas A. Swift's Electric Rifle." That is, a TASER.



**The Science: iPads**
**The Fiction: *2001: A Space Odyssey***

In 2011, Apple sued Samsung for copying the iPad. But Arthur C. Clarke beat them both to it in 1968. In his classic novel, Clarke describes a digital "Newspad": "One by one, he would conjure up the world's major electronic papers ... A postage-sized rectangle would expand till it neatly filled the screen and he could read it with comfort."

# 9 Absolutely Unbeatable Feats

Whoever said "records are meant to be broken" wasn't familiar with these.

BY **NICK GREENE** + ILLUSTRATION BY **ERIC NYFFELER**

## 1 POPE WHO FATHERED THE MOST CHILDREN

**Pope Alexander VI: At Least Four**

Renaissance popes were a little different from the average modern pontiff. Take Alexander VI, who, as a young priest, fathered at least four children with a mistress. (Some historians argue he had up to 10 kids, but he only acknowledged the four birthed by his *favorite* mistress.) While Alex wasn't the last dad-pope—Leo XI had three illegitimate children before donning the big hat in 1823—we bet his record won't be broken anytime soon.

## 2 HARDEST KICK TO THE FAMILY JEWELS

**Kirby Roy: 1,100 Pounds of ... OUCH!**

Speaking of reproduction, in 2010, the martial artist Kirby Roy willfully endured a 22-mph kick to the groin from a mixed martial arts fighter. The blow was calculated to have delivered 1,100 pounds of force. Roy, who has spent decades conditioning his body to calmly take these kinds of attacks without pain, hardly flinched. As one would imagine, formal attempts to break his record are few and far between.

## 3 GREATEST VIDEO CASSETTE COLLECTION OF *JERRY MAGUIRE*

**Everything Is Terrible!: 11,929 (at press time)**

Chicago's Everything Is Terrible! is a library of videos and digital kitsch from the 1980s and '90s. Since 2008, its team has been collecting VHS copies of *Jerry Maguire* with the aim of owning every one in the world. (If you don't want yours, they'll gladly take it.) They recently celebrated their growing collection by making a throne entirely out of the tapes.

## 4 MOST COMPLETE GAMES IN A BASEBALL SEASON

**Will White: 75 Complete Games**

Baseball is full of unbreakable records. Nobody will touch pitcher Cy Young's 511 wins. Joe DiMaggio's 56-game hitting streak will likely stand the test of time, too. But the most impossible record may be Will White's 1879 season with the Cincinnati Reds, when he pitched an astounding 75 games from start to finish. For reference, most starting pitchers only pitch 30 games all season. But let's throw modern pitchers a bone. White was tossing underhand, after all.

## 5 LONGEST MANNED FLIGHT

**Robert Timm and John Cook: 64 Days**

Between December 1958 and February 1959, an airline pilot and a slot machine mechanic lived inside a Cessna 172 aircraft ... while flying it the entire time. Twice a day, a friend in a Ford pickup outfitted with a fuel pump drove down a dusty desert road as the men flew low and dropped a specially made hose for midair refueling. The two took turns sleeping and flying, and their feat lasted 64 days, 22 hours, and 19 minutes. They traveled 150,000 miles total.

## 6 GREATEST SIRE EVER

**Niall of the Nine Hostages**

You've maybe heard that 0.5 percent of the world's men are descendants of Genghis Khan. And while Khan does, in fact, have the world's largest lineage, the Irish King Niall of the Nine Hostages has the distinct honor of populating nearly an entire country. The 4th-century Irish king gained power by taking other royal families hostage, and his (many) descendants founded a slew of major Irish clans. About 20 percent of men in northwestern Ireland—and about three million worldwide—contain his Y chromosome.

## 7 MOST PEOPLE STUFFED INTO A PHONE BOOTH

**The Durban YMCA: 25 People**

In 1959, 25 young men at the Durban, South Africa, YMCA managed to stuff their bodies (or at least parts of their bodies) into a normal-sized phone booth. For the next few years, a fad of cramming people into tight spaces—cars, outhouses, photo booths—swept college campuses across the globe. But nobody could beat the Durban record, and nowadays, simply *finding* a phone booth is more impressive than stuffing two dozen people into one.

## 8 LONGEST TIME LOCKED IN A ROOM OF SNAKES

**David Jones: 121 Days**

In 2010, a British carpenter named David Jones spent four months locked in a room at a South African snake farm with 40 spouted cobras, green mambas, black mambas, boomslangs, and puff adders. He broke the previous record by eight full days—and didn't receive a single bite. When he emerged, the Guinness World Records committee, looking to discourage further attempts, announced that they had stopped acknowledging the record.

## 9 FARTHEST WATERMELON SEED SPIT

**Jason Schayot: 75 Feet, 2 Inches**

Watermelon seed–spitting is a dying art. Practicing has become nearly impossible, as the seeds are bred out of the pepo (a berry with a thick rind). Only 78 percent of the watermelons sold in stores today have seeds, says the National Watermelon Promotion Board. And that number is declining. To make things more difficult, the farthest distance the seeds have ever been hocked, a record set by Jason Schayot in 1995, exceeds the length of a tractor trailer.

# THE Librarian WHO TOOK ON Al Qaeda

*Protecting one book is easy. Saving 377,000 fragile historic documents from gun-toting vandals hell-bent on erasing centuries of knowledge? That takes a different type of hero.*

Mali's private libraries, like this one, the Fondo Kati, trace their literary treasures back centuries.

BY **JOSHUA HAMMER**
PHOTOGRAPHY BY
**ALEXANDRA HUDDLESTON**

**On Friday morning,** January 25, 2013, 15 jihadis entered the restoration and conservation rooms on the ground floor of the Ahmed Baba Institute in Sankoré, a government library in Mali. The men swept 4,202 manuscripts off lab tables and shelves and carried them into the tiled courtyard. They doused the manuscripts—including 14th- and 15th-century works of physics, chemistry, and mathematics, their fragile pages covered with algebraic formulas, charts of the heavens, and molecular diagrams—in gasoline. Then they tossed in a lit match. The brittle pages and their dry leather covers ignited in a flash.

In minutes, the work of Timbuktu's greatest savants and scientists, preserved for centuries, hidden from the 19th-century jihadis and French conquerors, survivors of floods, bacteria, water, and insects, were consumed by the inferno.

In the capital city of Bamako 800 miles away, the founder of Timbuktu's Mamma Haidara Library, a scholar and community leader named Abdel Kader Haidara, saw the burning of the manuscripts as a tragedy—and a vindication of a remarkable plan he'd undertaken. Starting with no money besides the meager sum in his savings account, the librarian had recruited a loyal circle of volunteers, badgered and shamed the international community into funding the scheme, raised $1 million, and hired hundreds of amateur smugglers in Timbuktu and beyond. Their goal? Save books.

**Months earlier, Haidara** had been pacing the courtyard at his home, pondering how to respond to the rebels' seizure of Timbuktu. Largely thanks to Haidara, the city now had 45 libraries, ranging from small private archives to 10,000-volume collections. The libraries served as repositories for a total of 377,000 manuscripts—from 400-hundred-page, leather-encased volumes to single folios—including some of the greatest works of medieval literature in the world. And now Al Qaeda was putting it all in jeopardy.

From *The Bad-Ass Librarians of Timbuktu: And Their Race to Save the World's Most Precious Manuscripts*, by Joshua Hammer
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The extremists had declared jihad against anything that challenged their vision of a pure Islamic society, and these artifacts—treatises about logic, astrology, and medicine, paeans to music, poems idealizing romantic love—represented 500 years of human joy. Jihadi spokesmen had appeared on radio and television twice soon after their capture of Timbuktu to reassure people that "we won't harm the manuscripts." But Haidara and most of his friends and colleagues dismissed the promise as a public relations ploy.

A few days after the occupation began, Haidara met with his colleagues at the office of Savama-DCI, the Timbuktu library association he had formed 15 years earlier.

"What do we have to do?" Haidara asked them.

"What do you think we have to do?" a colleague replied.

"I think we need to take out the manuscripts from the big buildings and disperse them around the city to family houses. We don't want them finding the collections of manuscripts and stealing them or destroying them."

Months earlier, the Ford Foundation office in Lagos, Nigeria, had given Haidara a $12,000 grant to study English at Oxford University in the fall and winter of 2012 to 2013. The money had been wired to a savings account in Bamako. He emailed the foundation and asked for authorization to reallocate the funds to protect the manuscripts from the hands of Timbuktu's occupiers. The money was released in three days.

**HAIDARA TOLD NOBODY OUTSIDE HIS FELLOW LIBRARIANS WHAT HE WAS DOING—NOT EVEN HIS FAMILY.**

Haidara recruited his nephew Mohammed Touré, who had worked with Haidara at the library since he was 12. Touré and his uncle reached out to people they trusted—archivists, secretaries, Timbuktu tour guides, and half a dozen of Haidara's nephews and cousins. The volunteers went from shop to shop in Timbuktu's commercial district, buying between 50 and 80 metal trunks a day as discreetly as possible. When the metal lockers were sold out, they bought lesser-quality ones in wood. When they had purchased every trunk in Timbuktu, they swept through markets in the riverside town of Mopti. When they had bought up every one in Mopti, they purchased oil barrels in Timbuktu and shipped them down to Mopti workshops. Metalworkers broke the barrels, refashioned them into chests, and sent them back downriver to Timbuktu.

In one month, they accumulated 2,500 trunks and moved them into storage rooms inside the city's libraries to prepare for the evacuation.

**One evening** in late April, Haidara, Touré, and several other volunteers met in front of the Mamma Haidara Library and began the dangerous task of moving the manuscripts. They had waited until after dark—when they could work inside the library without attracting the scrutiny of the Islamic Police.

Carrying two trunks, the men moved silently across the courtyard, entered the main building, and locked the doors behind them. The rebels had cut the electricity in Timbuktu, obliging the librarians to use flashlights—only one or two to avoid drawing attention. Whispering among themselves in the darkness, and guided by the night watchman, they opened the cases in the main exhibition hall and delicately removed the volumes displayed inside. They groped their way down hallways and worked methodically in the conservation labs and library shelves where the bulk of the manuscripts were held. Keeping close track of the time, they limited themselves to two hours, packing in as much as they could, often in silence, listening for every suspicious sound. The manuscripts ranged from miniature volumes to large, encyclopedia-sized works, and required artful arranging,

Abde Kader Haidara organizes the manuscripts in the Mamma Haidara Library, which contains more than 9,000 ancient works

in near-total darkness, to maximize space. Because of the speed with which the volunteers were forced to work and the shortage of funding, they used no cushioning, no cardboard boxes, and no humidity traps to protect from potential damage.

When they had finished packing, they sealed the chests with padlocks, locked the door of the library behind them, and hurried home down shadowy alleys, keeping a sharp eye out for Islamic Police patrols. The following evening, they returned to the library, picked up the lockers, wrapped them in blankets, and loaded them onto mule carts, which took them to private safe houses in the city. Haidara told nobody outside his fellow librarians what he was doing—not even his immediate family.

**Haidara wanted to keep** the manuscripts in Timbuktu. But in the summer of 2012, the jihadis there went on a rampage, destroying a dozen Sufi shrines. In August, Libyan Wahhabis, known as Najdis, outdid their Timbuktu counterparts. They desecrated dozens of graves in a Sufi cemetery in Tripoli's Old City, knocked down a mausoleum in Misrata and three in Tripoli, bulldozed and blew up the shrine of a 15th-century Sufi scholar in the Mediterranean coastal town of Zlitan, and fired mortar rounds at the mosque and library of Al Asmari University in the same city. The shells ignited a fire inside the library that burned thousands of manuscripts to ashes. The safe houses no longer felt safe. Haidara recalled, "I knew we didn't have much time." He decided to transport the manuscripts to Bamako, 606 miles to the south.

But moving hundreds of thousands of priceless and fragile artifacts over unpredictable terrain would be dangerous and hugely expensive. Haidara knew he would need to hire couriers and drivers and rent hundreds of trucks, four-wheel-drive vehicles, and taxis. Additionally, they'd need cash for bribes, spare parts, repairs, and gasoline. Emily Brady, a scholar from Washington state who had become captivated by Haidara's collection during a visit to Mali in the 1990s, calculated a budget of $700,000. They reached out to contacts around the world. Haidara secured $100,000 from one of his most generous benefactors: Dubai's Juma Al Majid Center. A grant of $135,000 from the Prince Claus Fund in the Netherlands also came through. A Kickstarter campaign raised another $60,000. The Dutch National Lottery, one of the richest cultural foundations in the Netherlands, wired $255,000.

Meanwhile, in Timbuktu, Touré cast about for sturdy four-wheel-drive vehicles and recruited drivers and couriers. The majority were teenagers, the sons and nephews of Timbuktu's librarians—people whose loyalty would remain unquestioned.

At dawn one morning in late August, Touré and a driver parked a Land Cruiser in front of a safe house in Timbuktu and loaded it with five chests filled with 1,500 manuscripts from the Mamma Haidara Library. Each chest was 4 feet long by 2 feet wide and 2 feet deep, and could snugly fit up to eight stacks of manuscripts. He draped a blanket over the footlockers, and climbed in the Land Cruiser beside the driver. A chill desert wind blew as they pulled away from the safe house and, beneath a brightening sky, drove south, past the Islamic Police headquarters in the former Commercial Bank of Mali. The turbaned fighters who manned the first checkpoint on the southern outskirts of Timbuktu waved him through. They passed

the municipal airport and there the tarmac ended. He crossed the Niger River by car ferry and then for several hours drove on the sand track south, through an undulating landscape of dried-out riverbeds and faint patches of grass, scattered acacias, and scrub.

The vehicle reached Konna, beside the Niger, a town of mud huts, labyrinthine alleyways, and a small mosque modeled after the Great Mud Mosque of Djenné. Konna marked the start of Malian government territory. Touré called Haidara on his cell phone and informed him with relief that he was now in the zone of safety. Then, just south of the line of control, his illusions of safety dissolved. Malian troops—edgy, demoralized, and suspicious of anyone coming from the occupied north—stopped him at Sévaré.

They pointed rifles at his chest and ordered him out. "Remove the trunks." One by one, Touré and his driver pulled the manuscript-filled chests out of the rear compartment.

The soldiers smashed the locks on the chests with their gun butts, pulled out the volumes, and flipped roughly through the fragile pages. Touré kept silent as he watched them manhandle the precious volumes.

For two days and nights they kept him and his driver under guard in a spartan camp beside the roadblock, feeding him but refusing to explain why they were detaining him. At last, they told him he could go. In the riverside town of Ségou, Touré hit another military checkpoint marked by 4-foot-high metal oil drums strewn across the road. "What's this? What are you doing? What are you smuggling?" the soldiers demanded. As Touré watched helplessly, they broke the locks for the second time, and rifled through the manuscripts one by one.

When Touré reached Bamako's Porte d'Entrée, where the military searched every vehicle entering the capital, Touré was detained again. Exhausted and hungry, he was taken to a camp, thrown into a filthy cell, given nothing to eat or drink, and interrogated. Touré was permitted one phone call, to Haidara, who arrived at dawn with tea and bread, ate with him in his cell, and freed him with a "gift" to his jailers.

It had been a terrible ordeal that had lasted a week, yet no sooner had Touré delivered his cargo to safe havens in Bamako than he returned to Timbuktu and prepared for the next journey. Touré would make more than 30 round-trips between Timbuktu and Bamako, personally saving tens of thousands of manuscripts.

**Every day, sometimes five times** a day, Haidara traveled to the Porte d'Entrée, on Bamako's northern outskirts. Lengthy negotiations—and the invariable payment of "gifts"—allowed his hundreds of couriers to slip through. Some returned to Bamako so shaken that they dropped out after a single mission, but most remained committed to the end. During the first 90 days, Haidara's couriers evacuated about 270,000 of the 377,000 manuscripts, nearly three-quarters of the books that had been held in the city's safe houses. But that July, Haidara's evacuation plan ground to a halt.

War had broken out across the north. The French military had intervened and stopped the jihadis from capturing Bamako and declaring all of Mali a caliphate. The manuscripts were at risk from both Al Qaeda, who seemed likely to lash out at anything that the West considered valuable, and from the French military, which had turned the entire north into a zone of gunfire and destruction. A total of 791 footlockers containing 100,000 manuscripts remained trapped in safe houses in Timbuktu. Desperate,

Timbuktu sits on the southern fringe of the Sahara desert in Mali, where daily temperatures average 100°F.

Haidara was obliged to consider the only viable alternative to the road: the Niger River.

Haidara's team recruited dozens of local boatmen and laid out the rules: Their destination would be Djenné, on the floodplain between the Niger and the Bani Rivers, 223 miles and two days south of Timbuktu. Once the footlockers had been unloaded safely in government territory, trucks, taxis, and other vehicles would receive the cargo and continue the journey to Bamako, 332 miles further south.

A lone vessel left on a test run. The 30-foot boat motored down the center of the river. Then, with alarm, the couriers and captains heard an engine and the whir of rotor blades. A French attack helicopter swooped down low over the water and hovered above the craft. "Open the footlockers," they demanded over a loudspeaker. The French warned the crew that they would sink the boat on suspicion of smuggling weapons if the couriers refused.

**TOURÉ WAS TAKEN TO A CAMP, THROWN INTO A FILTHY CELL, GIVEN NOTHING TO EAT OR DRINK, AND INTERROGATED.**

The terrified teenage couriers flung the chests open and stepped aside. The pilots could see that the chests were filled with only paper and flew off.

Shortly afterward, 20 vessels, each carrying 15 metal chests filled with manuscripts, motored in a convoy down the Niger from a port near Timbuktu. As the convoy threaded its way along channels through the grass, a dozen turbaned men brandishing Kalashnikovs emerged from the dense vegetation. They were bandits and ordered the flotilla to stop. Forcing the couriers to open the locks, the men thumbed through the Arabic texts. "We will keep these," they announced.

The couriers pleaded with them and offered their cheap Casio watches, silver bracelets, rings, and necklaces. When that failed, they called Haidara, in Bamako. He urged the bandits to release the couriers and the cargo, promising to deliver a sizeable ransom.

Haidara couldn't afford not to pay them, he would later explain: Thousands of other manuscripts were already heading downriver. The couriers waited nervously while the bandits debated what to do. At last, the gunmen released the boats and the manuscripts. One of Haidara's agents, as promised, delivered the cash four days later.

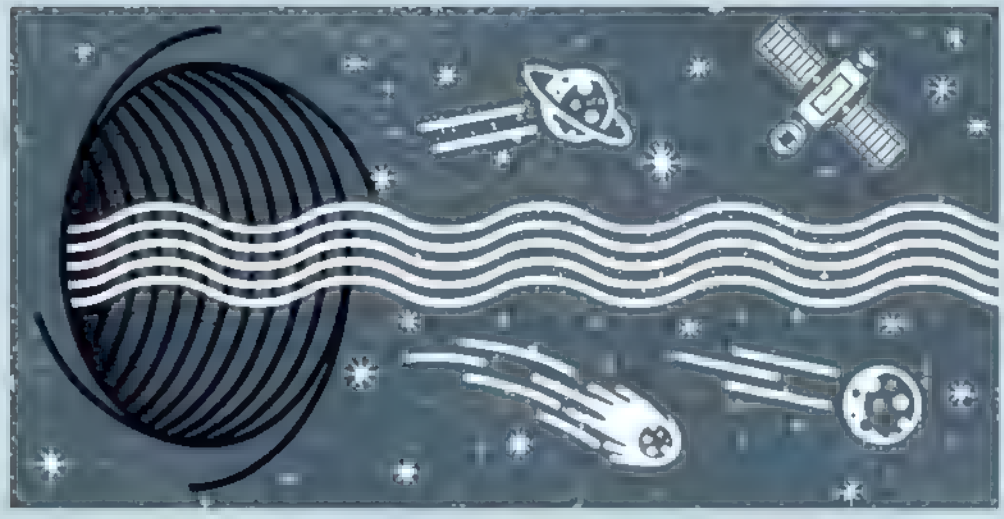
In Bamako, Haidara spent 15 hours a day talking simultaneously on eight cell phones to his team of couriers, whom he had instructed to brief him every 15 minutes when they were on the road. Huge sheets of brown butcher paper taped to one wall tracked the names of the teenagers, their latest cell phone contacts, the number of footlockers each was carrying, their locations, and conditions en route. Text messages were sent to donors informing them of progress: 75 FOOTLOCKERS GOING THROUGH, OUR KIDS HAVE MADE IT ACROSS LAKE DÉBO, ARE NOW IN MOPTI. During one frenetic day toward the end of the boatlift, 150 taxicabs, each carrying three footlockers and a courier, made the journey from Djenné to Bamako.

In a low-tech operation that seemed quaint in the second decade of the 21st century, Haidara and his team had transported to safety, by river and by road, past hostile jihadi guards and suspicious Malian soldiers, past bandits, attack helicopters, and other lethal obstacles, almost all of Timbuktu's 377,000 manuscripts. Not one had been lost en route. "Abdel Kader and I experienced something I have trouble describing. Power, strength, perseverance can't adequately articulate what it was," Brady said in an interview on Reddit. "We kept thinking that we had to lose some manuscripts—theft, bandits, belligerents ... combat, books in canoes on the Niger River—we had to lose some, right? Well, we didn't. Not a single manuscript was compromised during the evacuation—nada, zero. They all made it." ❀

# How's *That* Going?

## Checking on the progress of the impossible

BY FOSTER KAMER



### PERPETUAL MOTION

Leonardo da Vinci once compared those in pursuit of perpetual motion to alchemists (basically, they were fools). It's the idea that we could create a machine that could power itself forever, essentially suggesting that "what goes up must come down" isn't true. But so far, turning the idea into reality has proven difficult. There have been so many attempts to patent nonfunctional (read: fake) perpetual motion machines, the United States Patent and Trademark Office has a categorized collection of perpetual motion "gimmicks." Somewhere, da Vinci can't stop giggling.

### FIGURING OUT WHAT'S IN A BLACK HOLE

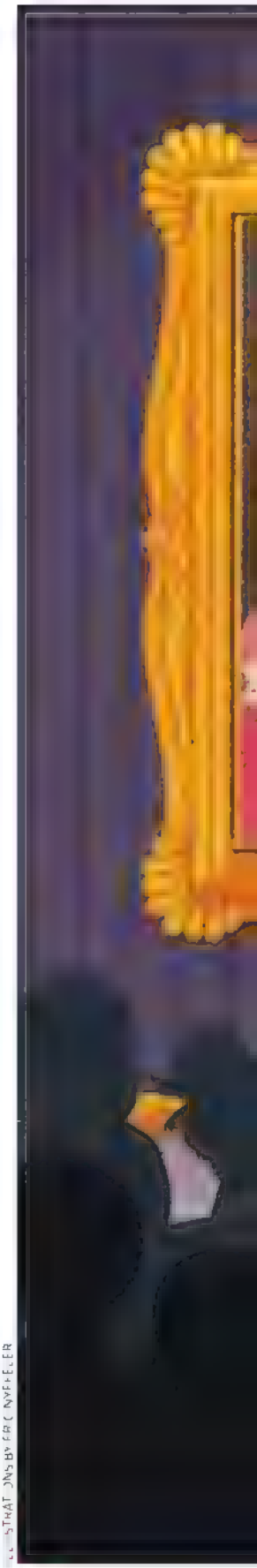
We thought we'd never see anything come out of a black hole. But in October 2015, NASA's Explorer missions Swift and the Nuclear Spectroscopic Telescope Array "caught a supermassive black hole in the midst of a giant eruption of X-ray light." Traditionally, black holes were thought to have gravitational pulls so strong, nothing could escape their grasp. But the finding showed that's not entirely true—black holes can emit X-rays. We don't know why this happens yet, but the technology enabled us to know that a black hole is more than just a cosmic Cookie Monster that eats everything it sees.

### COLD FUSION

To date, all known forms of energy production require heat. If it could be created at room temperature, that would mean limitless free and clean energy. But as science writer Sam Kean once put it, "Among physicists and chemists, cold fusion enjoys a reputation about on par with creationism." In 1989, electrochemists Martin Fleischmann and Stanley Pons claimed to have created cold fusion—when it turned out they didn't, their reputations were shot. Not much has changed since. In 2014, Lockheed Martin embarked on a plan to craft a "compact fusion reactor" that could yield a similar (albeit much warmer) result. But so far, nada.

### A CURE FOR BALDNESS

The problem with hair is that we're born with a finite number of follicles, and once they shut down, they can't be resurrected. Steroids can help stave off hair loss, and follicles can be transplanted from other parts of the body, but ultimately, once a hair is gone, it's gone—forever. However, pharmaceutical companies are trying to figure out a way to Frankenstein follicles—and not just revive them, but get them to produce new hair. Results have been varied. One 2015 stem cell experiment showed promise in "inducing a robust hair growth," but that was only on mice.



# A Royal Ruse

## *How a psych patient convinced everyone she was a Russian princess*

BY ERIN BLAKEMORE

Two years after Tsar Nicholas II and his family disappeared during the 1918 Bolshevik Revolution, a woman was admitted to a German psychiatric hospital after jumping off a bridge. Her name was a mystery, so she was called *Fräulein Unbekannt*, the equivalent of Jane Doe. But shortly into her stay another woman in the hospital put forth a theory that she was Tatiana, one of the tsar's missing daughters. The patient did nothing to correct her, and rumors began to swirl in the press. After a friend of the Romanovs purported she was too short to be Tatiana, word started to spread that she was actually the Grand Duchess Anastasia.

By the time the woman left the hospital, enough people were convinced of her identity that members of high society took her in. (After all, nobody knew what Anastasia, who was captured at 16 years old, looked like all grown up.) Even Anastasia's uncle took the bait. For the next decade, "Anastasia" visited and convinced a number of "old friends" and "relatives" of her authenticity. Despite some weird exploits—she was once found on a hotel roof naked and accused of murdering a pet parakeet—she had a knack for socializing that beguiled her hosts. (She didn't speak Russian, but *that* red flag somehow bothered only a handful of people.)

Ten years after the tsar's disappearance, Russian officials ruled that his relatives could recover his possessions, and the remaining members of the family banded together to denounce the woman as an impostor. In 1938, her identity was challenged in German court. The final ruling wasn't reached for 32 years, making it the longest case in German history. The verdict: Neither yes nor no—she hadn't provided enough evidence that she was, and her detractors hadn't provided enough evidence that she wasn't.

But the woman, who had by then adopted the moniker "Anna Anderson," had a ready work. She worked her way from a hospital bed to the drawing rooms of Russia's elite. And when she moved to the U.S., she started the charade again. "You either believe it or you don't believe it," she reportedly said. Royalty or not, it's hard to argue with that logic.

(NEARLY IMPOSSIBLE!)

# The Magic of Steph Curry

Mathematically speaking, Stephen Curry shouldn't exist. His career is so statistically unlikely, it just might make you a basketball fan if you're not already. Allow us to crunch the numbers.

BY **BETHLEHEM SHOALS** & **SILVERBIRD 5000**

**400 POUNDS**
Curry weighs 190 pounds but can deadlift 400. That's the same weight-to-lift ratio as a competitive bodybuilder.

**6'3"**
Curry is not a tall guy by NBA standards, but he can make long shots partly because of his outrageous core strength.

**Season Highlights:**

- Curry won the NBA's Most Valuable Player award in 2016, his second in a row.
- This year he's on track to score the most points in the league regular and post-season combined.
- Overall, he's made 50 percent of his baskets, 45 percent of his three-point shots, and 90 percent of his free-throw opportunities, becoming the seventh member of the prestigious "50-40-90 club," joining giants like Larry Bird.

**THE COMBINED ODDS OF EACH OF THESE ACCOMPLISHMENTS:**

most points in the NBA: **1:476** x

MVP awards in a row: **1:1,904** x

50-40-90 season: **1:1,254** =

IT TAKES CURRY

# 300

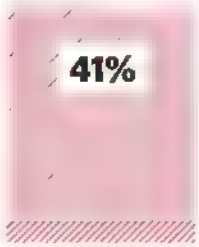
MILLISECONDS TO SHOOT

OTHER THINGS THAT HAPPEN THIS QUICKLY

- The blink of a human eye
- The average reader processes a single word.
- The star-nosed mole finds, catches, and eats food.

**The Three-Point Bubble:** Curry didn't just shatter the NBA record for three-point shots in a season—he *destroyed* it.

**PREVIOUS RECORD:** 286 BASKETS
**NEW RECORD:** 402 BASKETS
(THE PREVIOUS RECORD WAS ALSO CURRY'S)




**1.15%**
Percent by which Usain Bolt beat the 100-meter dash record

**4%**
Percent by which Barry Bonds beat the single-season home run record

**41%**
Percent by which Curry beat the three-point total record

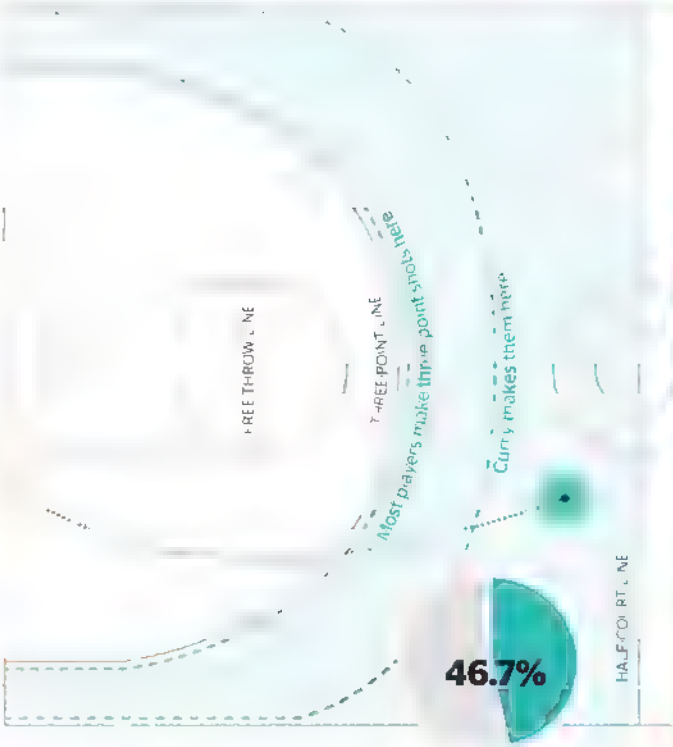
**135 MILLION**

Combined views of Curry's top 50 YouTube clips this year. The top clips for Jarrett Jack, an above average NBA journeyman: 250,000 views.

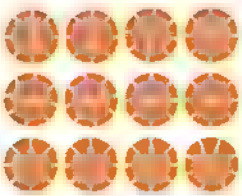
**The Kicker:** With the exception of NBA legend Bill Walton, no MVP has played *less* basketball than Steph Curry.

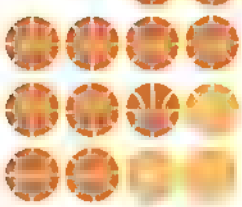
82

**From *Waaaaay* Downtown:** The NBA three-point line ranges from 22 to 24 feet from the basket. But Curry regularly sinks shots from 30 feet—more than anyone in the league.




**21**
The number of 30-foot three-point shots Curry made this season





**3**
The number of 30-foot three-point shots made by Klay Thompson, the NBA's runner-up

Curry's made a ridiculous 46.7 percent of his shots from far behind the three-point line. To compare, the NBA as a whole makes 45.2 percent of shots—from *anywhere*.

There are 82 games per NBA season. But if you tallied up all of Curry's court time, he only played the equivalent of 56.3 games. (To avoid injury, he was often taken out of games his team was winning.)

**THOSE ARE THE SAME ODDS AS MEETING ONE'S DEMISE BY FIREWORKS ON LEAP DAY, OR ROUGHLY EQUIVALENT TO THE ODDS OF BEING EATEN BY A SHARK AFTER SCORING A HOLE IN ONE.**

A. AMY

Odds on all that happening in the same season

# 1:136,505,216

# The Art of Persistence

## *How a one-handed concert pianist changed music*

BY **LUCAS REILLY**

Paul Wittgenstein was on a reconnaissance mission when a bullet tore through his right arm. It was the dawn of the First World War August 1914, and Wittgenstein—a second lieutenant in the Austrian army—had been spying on a group of Russian soldiers across a river when, out of nowhere, shots rang out. When he awoke in an army hospital hours later his arm was gone.

It was an especially tragic blow. Wittgenstein was an up-and-coming concert pianist. Raised in one of Vienna's wealthiest families, he seemed destined for the stage. His family home had *seven* grand pianos. Frequent guests there included musicians such as Johannes Brahms and Clara Schumann. By his mid-twenties, he was playing with orchestras.

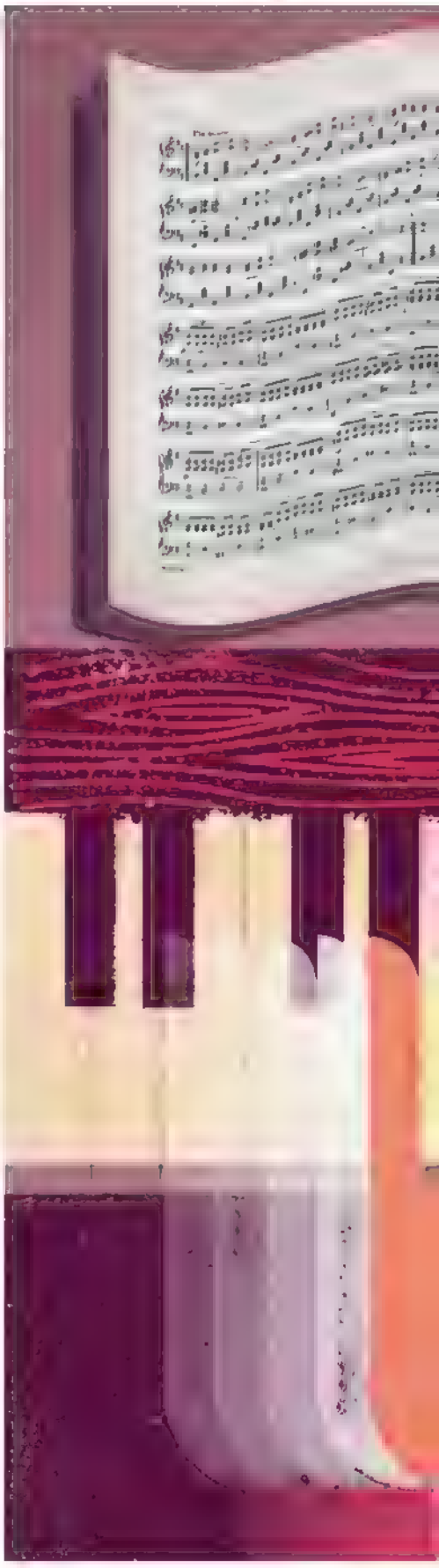
When news of Wittgenstein's amputation reached Vienna, everybody assumed his musical aspirations disappeared with his arm. His brother, the not-yet-famous Oxford philosopher Ludwig, wrote, "I keep having to think of poor Paul who has so suddenly lost his career ... What philosophy would it take to get over that!" Wittgenstein, however, had other ideas.

The amputation occurred at an Austrian army hospital, and shortly after the ward was captured by Russians and Wittgenstein was sent to a prison camp in Siberia. One bright note in this turn of events was the upright piano a sympathetic guard had delivered to his room. He started practicing on it with his remaining hand. As Alexander Waugh writes in *House of Wittgenstein*, "The trauma of his condition had, if anything, made him more determined than ever to return to his homeland and resume his concert career."

In 1918, Wittgenstein went back home and began practicing seven hours a day—sometimes in one sitting. After a few false starts, he returned to the public stage for good in 1921, stunning the crowd. "With closed eyes it would have been near impossible to detect how many digits were actually involved in his renditions," wrote one critic. A career touring Europe followed.

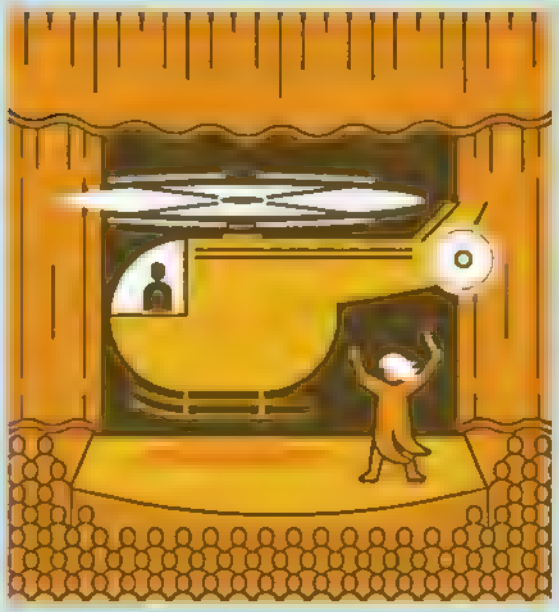
Thanks to his family connections, Wittgenstein was able to commission left-handed pieces from Europe's most coveted composers.[1] He even persuaded Maurice Ravel, the rock star of French impressionism, to write a piano concerto for lefties. The premiere, one critic wrote, "unleashed a storm of applause." Today the composition is considered among Ravel's best.

Wittgenstein's misfortune had one unforeseen advantage: It forced composers like Ravel to look at the piano with fresh eyes. Until then, most one-handed piano works were simply boring technique exercises. But now composers were expected to make art. By the time of his death in 1961, Wittgenstein had commissioned hundreds of one-handed pieces, including 17 concertos. Today, able-bodied pianists view those pieces as an unusual challenge, while one-handed musicians view them as a godsend—and a testament to never giving up.



By the 1930s Wittgenstein was in such high demand that he turned into a bit of a diva. When the renowned composer Sergei Prokofiev wrote him a concerto for his left hand Wittgenstein replied, "Thank you ... but I do not understand a single note and I shall not play it."

ILLUSTRATIONS BY EMILY NEFFLER



# 4 Impossible Musical Pieces

Not all tunes were meant to see the stage.

### An Opera for Helicopter Pilots

A cycle of seven operas that lasts 29 hours, Karlheinz Stockhausen's *Licht* stretched the art form to its limits. The cycle has been performed in its entirety only once—partly because one scene, "Helikopter-Streichquartett," is a logistical nightmare: The piece requires a string quartet and four helicopters. To pull it off, each musician sits inside a hovering chopper, playing eerie tremolos that, with the help of a sound engineer, blend with the whir of the helicopter's rotors.

### A Safety Dance for Bomb Squads

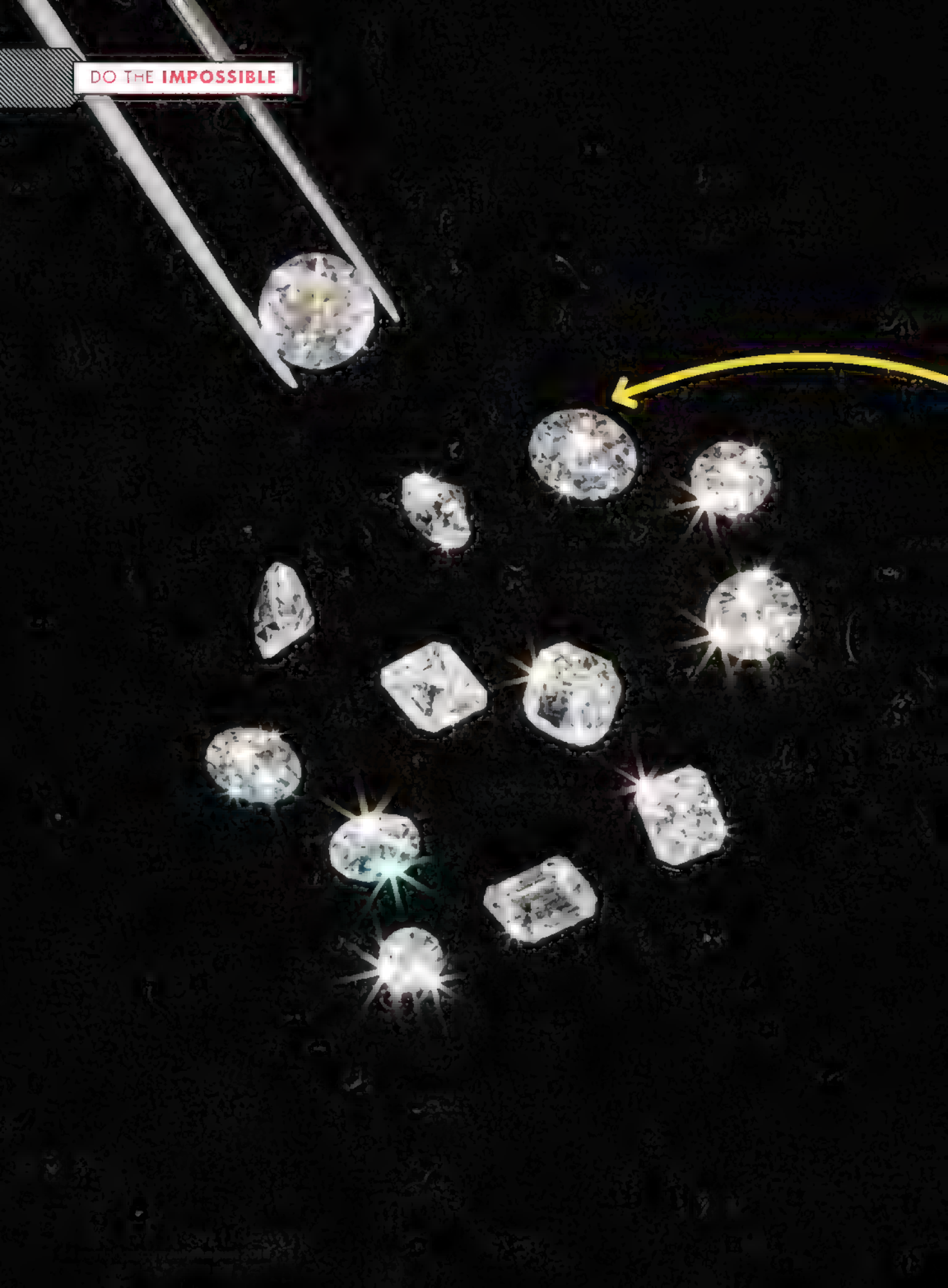
Philip Corner is an American composer, trombonist, and aiphorn player (it's like Switzerland's spin on the didgeridoo). In the 1960s, the Korean War veteran grew adamantly opposed to the conflict in Vietnam, so he composed a protest piece titled "An antipersonnel CBU-Type cluster bomb will be thrown into the audience." The composition fits into a genre aptly called "danger music." It's never been performed and is traditionally canceled before each concert.

### Saloon Tunes for Automatons

The American-Mexican composer Conlon Nancarrow wove melodies into knotty counterpoint, mixed time signatures, and wrote chords so thick even a six-handed pianist couldn't play them. Realizing that performing his compositions was physically impossible, he started writing for player pianos instead. A mix of honky-tonk and musical mathematics, his work, as NPR reports, sounds like a "turn-of-the-century roadhouse gone berserk."

### A Fugue for Hairstylists

Korean-American Fluxus composer Nam June Paik made a living creating art that was beyond avant-garde. The score for his "Variations on a Theme by Saint Saëns" has a cellist play "The Swan," then dunk herself in an oil drum full of water. His most impossible piece? "Homage to John Cage," which directs the artist to destroy two pianos while cutting the famed composer's necktie "and shampooing him without advance warning." Considering Cage has been dead for 24 years, this work would be a little difficult to perform.


DO THE IMPOSSIBLE

BY **ALINA SIMONE**
PHOTOGRAPHY BY **JAKE STANGEL**

# DO YOU KNOW *What This Is?*

*Is a diamond still a diamond if you can make it in a space-age oven? Inside one company's mission to find out.*

**It doesn't look like** the entrance to a paradigm-shifting, potentially world-changing start-up, but there it is: an unmarked door, facing out of a low-slung beige building on a street lined with tune-up shops. Inside, the scene is equally unassuming. There's a man wearing black gloves, seated in front of a box about the size of a passenger van that's blasting an ominous *om-mmm*.

Welcome to California's shiniest new diamond mine.

From the other end of the room, Martin Roscheisen, Diamond Foundry's CEO, is explaining what, exactly, is going on here. That box is called a growth reactor, he says. Basically, it's an atomic oven. Inside, a tiny diamond, known here as a "seed diamond," sits waiting to be blasted with hot plasma. The reaction will cause the crystal lattice-work of the diamond to extend. In other words: From this seed, a new diamond will start to grow.

"They grow slowly, atom by atom, and there's about one quadrillion atoms per layer," Roscheisen shouts over the din. "So it's a slow-growth process." By slow he means two weeks, which is how long it takes the Silicon Valley–based company to hot-forge jewelry-grade diamonds

identical to those the earth takes eons to mete out.

Roscheisen is lanky, with a boyish face and clear plastic glasses. He has a surprisingly honkish laugh, which he lets out when asked whether he likes to check on his diamonds "like muffins in an oven." (Answer: He does. The reactor has a window.)

Diamond Foundry launched to exuberant press last November, promising to "reimagine the diamond industry." It's an industry that is notorious for environmental and human rights abuses, most notably in Africa, where our lust for diamonds has fueled civil wars in seven countries, leaving millions dead, maimed, or displaced. "This is fundamentally about creating a better choice," Roscheisen says. "Our product is a better diamond in every way. It is materially pure. It is ecologically pure. It is made in America."

The Foundry's machines are helmed not by child laborers but white-collar professionals. These are eco-friendly diamonds (even the energy required to create them is offset by the purchase of solar power credits), yet they're atomically identical to nature's gems. It's an achievement Maarten de Witte, one of Diamond Foundry's master cutters, describes as "beyond the dreams of the ancient alchemists of turning lead into gold."

But the company faces an uphill battle if it's to realize a world with no diamond mines. Convincing people to wear man-made diamonds is one thing. There's also the very profitable industry built around mined diamonds (this year, *Bloomberg* reported that sales hit $79 billion worldwide), which means that man-made diamonds are banned from the world's largest diamond trading floor, in Israel. "They don't fit in our stores," Mark Aaron, vice president of investor relations at Tiffany and Co. told *The Wall Street Journal* in 2007. "Natural diamonds fit in our stores—diamonds that come out of the ground."

So even if Diamond Foundry has achieved the seemingly impossible, the real alchemy is just beginning. It has nothing to do with the perfect alignment of atoms, but rather, decades of seductive advertising. Can it convince consumers that a weeks-old diamond baked in a machine is just as valuable as a billion-year-old stone?

**CAN CONSUMERS BE CONVINCED THAT A DIAMOND BAKED IN A MACHINE IS AS VALUABLE AS A BILLION-YEAR-OLD STONE?**

**Man-made diamonds might** sound hypermodern, but the science was actually decoded in 1954 by H. Tracy Hall, a GE chemist who earned just a $10 savings bond for his discovery. Any diamond, whether it originates below ground, above ground, or in outer space[1], is made of carbon. Natural diamonds are formed 100 miles below the earth's surface, where temperatures hover above 2,000°F. There, carbon is crystallized by immense heat and geological pressure before the gems rocket to the earth's surface by way of volcanic flues.

Historians estimate that the first diamond mines were established as early as the 4th century BCE in India, where the stone was revered for its strength. Over two millennia later, that strength sparked a technological arms race to synthesize the gem. After World War II, there was a global shortage of industrial diamonds, a key component in making the tools that build everything from munitions to subway tunnels. Hall was part of the team behind a GE mission called Project Superpressure, which succeeded in creating a press powerful enough to mimic the geological

[1] Diamonds have been found in meteorites.

New diamonds come out of the reactor covered in a dark film of carbon. Jeremy Scholz, Diamond Foundry's CTO, cleans them to prepare for cutting and polishing.

forces acting on carbon deep within the earth.

The process, known as high pressure, high temperature, involves sandwiching graphite between a natural diamond and a metal solvent, heating the press to above 2,552°F, and applying pressure. The melting metal acts as a catalyst, forcing the graphite to crystallize atop the diamond.

A second process, called chemical vapor deposition (CVD), was later developed, in which carbon-rich gases are combined with hydrogen in a chamber and exposed to enormous levels of heat. The gases react, causing carbon atoms to hitch onto the "seed" diamond.

The first jewelry-grade man-made diamonds weren't created until the 1970s. And only in the last decade have manufacturers produced stones rivaling those found in nature. Roscheisen says it took his team three years and five generations of reactors before they were able to efficiently produce the gems. Their process remains a tightly held secret, but the Gemological Institute of America, the world's top diamond-grading body, identified two samples submitted by Diamond Foundry as CVD diamonds.

"I really don't think they have a fundamentally different technology from other CVD producers," Wuyi Wang, the GIA's director of research and development, says, though, he explained, the Foundry might have modified the process to grow more crystals at faster speeds.

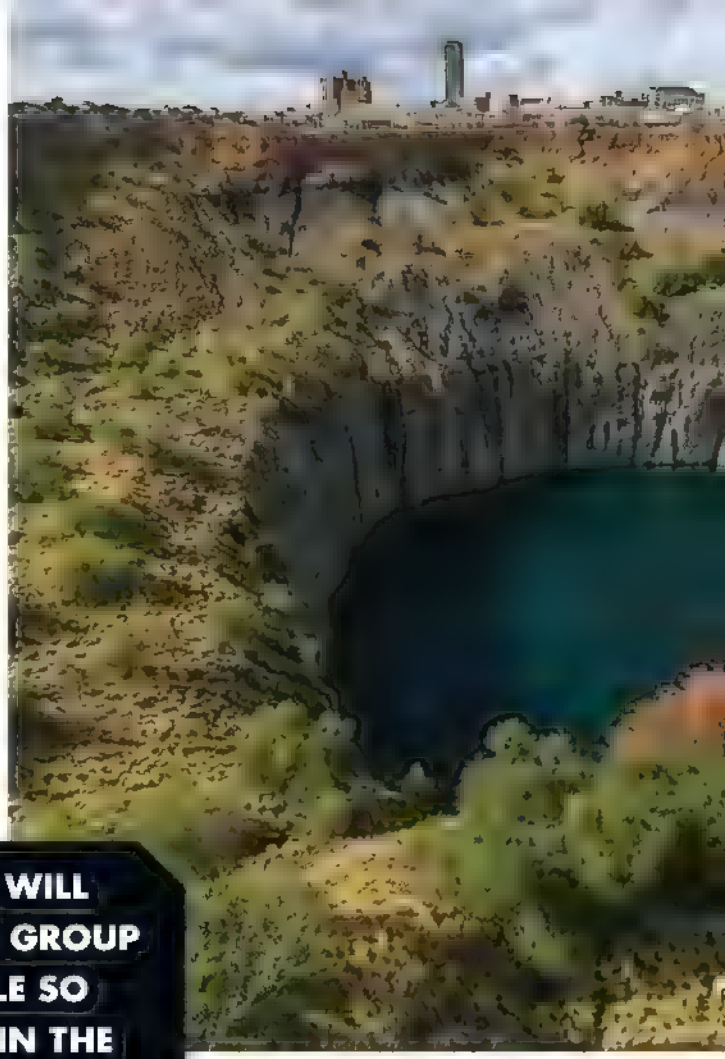
Other diamond manufacturers around the world make similar claims about stone clarity and technological improvements, so, technology aside, how is Diamond Foundry different? With famous billionaire investors—including Internet glitterati like Evan Williams of Twitter, Alison Pincus of One Kings Lane, and Andreas von Bechtolsheim of Sun Microsystems, as well as Leonardo DiCaprio, who starred in the movie *Blood Diamond*—it may be the first grower with sufficient brawn and e-commerce savvy to revolutionize the diamond market and pull off the impossible: to convince consumers a man-made diamond is "forever," even if it's only day-old.

**On the market,** a diamond is much more than a metastable allotrope of carbon—it's everlasting love. And credit for that goes to De Beers, which began the engagement campaign as part of a 1938 advertising blitz aimed at pulling the diamond market out of its Depression-era slump. Over the next 40 years, De Beers's advertising budget grew from $200,000 to $10 million per year as the industry realized the words they used to describe diamonds were as valuable as the stones they pulled from the ground. Diamonds were not just Forever, they were also a Girl's Best Friend, de rigueur for engagements, encouraged for anniversaries, a Valentine's Day staple. De Beers had stage-produced a massive increase in consumer demand to fuel a diamond market it already mostly controlled.

But there was a shocking secret behind De Beers's romance machine: Diamonds weren't actually valuable. De Beers stockpiled huge surpluses of the stone, artificially maintaining high prices. "Diamonds are intrinsically worthless," Nicky Oppenheimer, then-chairman of De Beers, admitted in 1999, "except for the deep psychological need they fill." Billions were spent creating that need, and even though man-made diamonds only account for up to 2 percent of jewelry sales, the industry shudders at the idea of competing with gems produced at the push of a button. Fears of infiltration aren't unfounded, either. In 2012, a lab in Antwerp discovered 600 man-made diamonds salted into a parcel of mined diamonds.

This is why you won't hear traditional diamond traders referring to the Foundry's product as a miracle; they employ a word that makes you think of plastic-wrapped cheese—"synthetic"—though they grudgingly accept "lab-grown," "man-made," or one of the other terms suggested by the Federal Trade Commission to ensure consumers know what they're buying.

After the synthetics-mixing scandal, the world's largest diamond exchange made its anti-man-made stance clear by adopting the slogan "Natural Is Real." In fact, nowhere will you find a group of people so passionately engaged in the definition of words like "real" and "natural" and "authentic" as in the diamond industry. Take Brad Con-



ALAMY, KIMBERLEY MINES REACTOR COURTESY THE DIAMOND FOUNDRY

gress—the "romance specialist of southwest Florida"—a third-generation, 44-year-old jewelry dealer.

He regularly pores over trade publications for ads employing "deceptive" language, sending findings to the industry's compliance arm, the Jewelers Vigilance Committee, whose staff has been known to hit shops incognito to ensure dealers aren't overreaching, word-wise.

Congress even invented and secured the URL for his own word, *diamonditis*, a term he defines, basically, as owning a diamond that isn't what you think it is. "Oftentimes I have to burst the bubble with someone. They thought they had something natural, and then [I] tell them, 'I am so sorry—it is synthetic.' That's why I'm so ethically charged on the subject," Congress says. "It hurts."

Neither he nor any estate dealer he knows will sell synthetic diamond jewelry. For Congress, the issue is financial. While some man-made diamonds retail for 10-30 percent less than natural stones, their cash-in value tends to be far lower. He also cites simple economics: As technology improves and it gets cheaper to manufacture more man-made diamonds, their value is bound to fall.

After all, a diamond may be forever, but the romance it commemorates often is not. Consequently, the resale market—which the mining industry can't control—remains overstocked. Diamonds are a terrible investment. Retail markups range from 100-200 percent, which means a typical diamond ring or bracelet loses at least 50 percent of its value as the jeweler's door shuts behind you.

**NOWHERE WILL YOU FIND A GROUP OF PEOPLE SO ENGAGED IN THE DEFINITION OF WORDS LIKE "REAL" AND "NATURAL."**

And when it comes to putting a price on factory-made diamonds, manufactured scarcity isn't exactly new. As De Beers once proved, value can be conjured from something as slight as a metaphor. Is it so impossible to imagine a techno-diamond also fetching a premium?

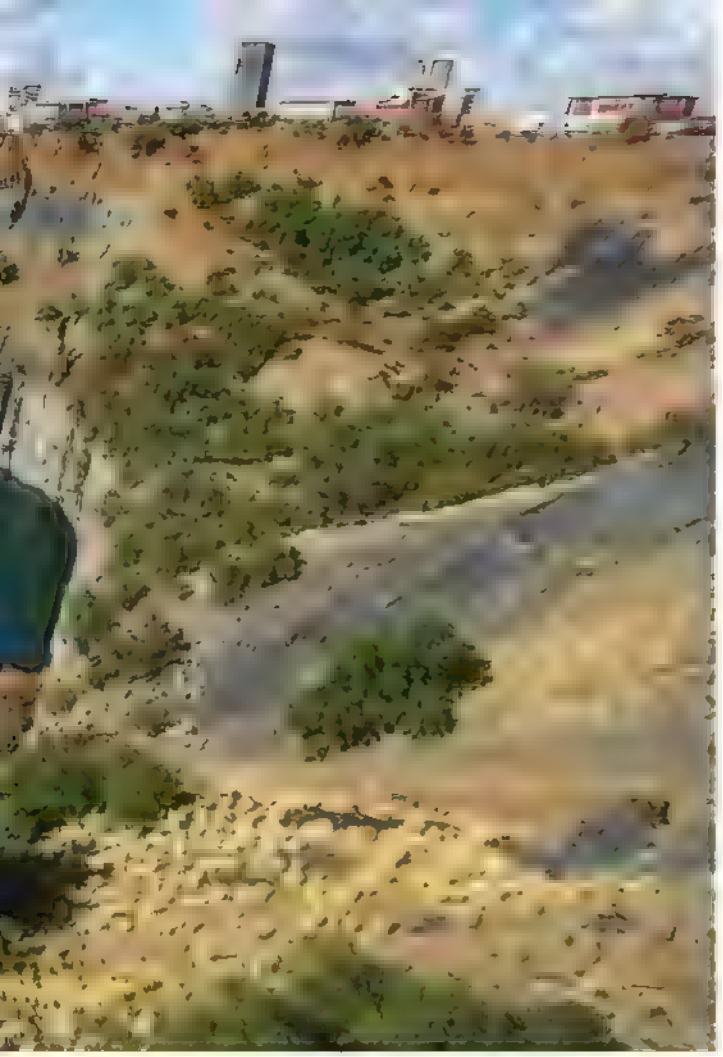
**It's tempting to assume** that someone committed to mined diamonds sees the industry's ecological and human rights problems as a necessary evil. Not Congress. He considers himself an environmentalist. He drives an electric car. Last year, he and his wife launched a jewelry line made from recycled gold. He's sympathetic to consumers wanting ethical, conflict-free stones, and steers them toward antique jewelry from an era predating industrialized mining. In fact, some of the industry's biggest players maintain a fierce commitment to mined stones while actively fighting the environmental and human rights abuses around them.

Two weeks before my visit to Diamond Foundry, in the eighth-floor conference room of a heavily fortified skyscraper at the edge of New York's diamond district, I sat facing one of these players: Martin Rapaport, a fire hydrant of a man who worked his way up from a job as a lowly diamond butcher, sorting and cleaving rough stone in Antwerp, to become one of the most important men in the industry.

Rapaport created the first global diamond pricing index (the "Rap Sheet") and heads a leading diamond trading network (RapNet). His influence within the clannish world of diamond dealers is regal and omniscient. But that day, he was yelling like the sidewalk barkers selling fried nuts on the street below.

"Leonardo DiCaprio is a rabbi taking ham sandwiches and telling everybody, 'They're kosher!' He is saying that a synthetic diamond, which takes food out of the mouths of people who are starving to death, is a better product to wear than something that could actually help these people by having a fair-trade diamond!"

Though Rapaport's career is built on diamonds mined from some of the poorest reaches of the globe, he's no apologist for the industry. Nearly seven years before *Blood Diamond* turned the human grist of Sierra Leone's mines



Left: Operational from 1871 to 1914, the Kimberley diamond mine in South Africa, called the Big Hole, was dug entirely by hand with picks and shovels. Below: A look inside Diamond Foundry's plasma reactor, in which 8,000-degree plasma deposits new layers of carbon onto a "seed" diamond.

into headlines, he toured the country's amputee camps.

"Thousands of people. An arm. A leg. An arm and a leg. Little children," Rapaport recalled. "You have to understand—my parents, they were in Auschwitz. I saw this and said, 'What the hell is this? This cannot happen.'"

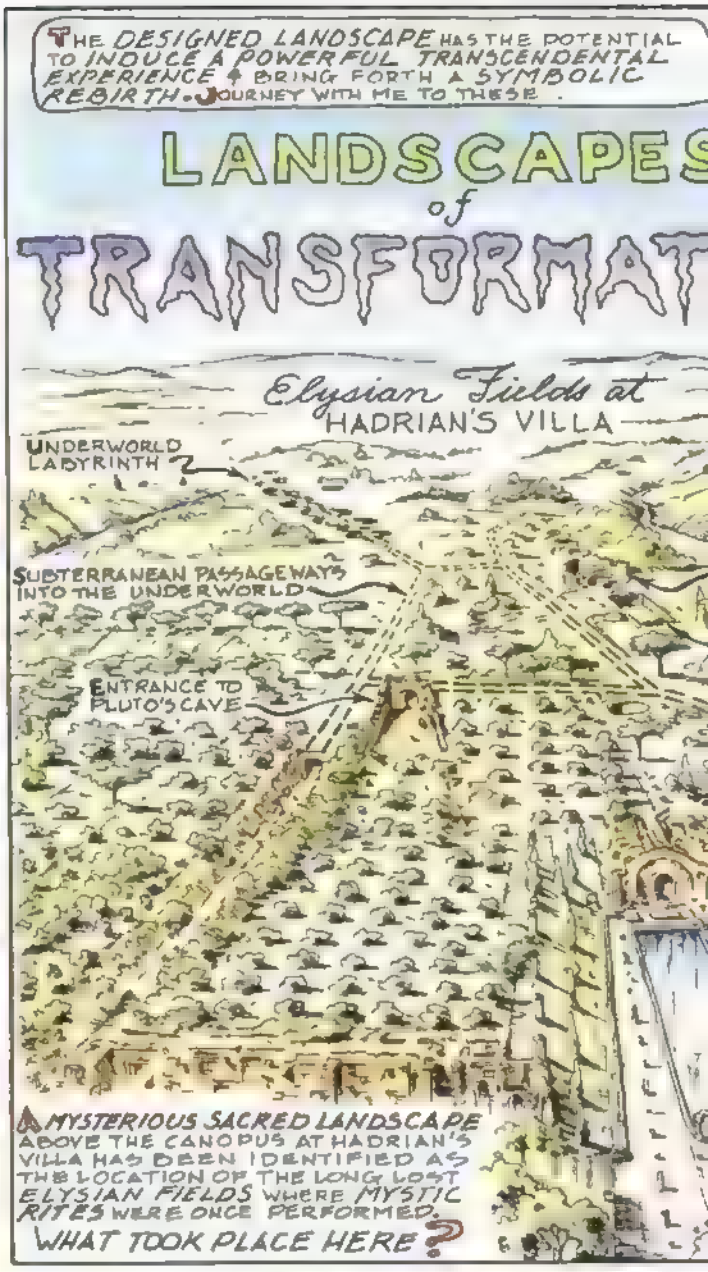
Despite the legacy of violence plaguing Africa's diamond mines, Rapaport believes in a solution: fair-trade diamonds, the proverbial $4 latte that lifts thousands of subsistence-level diggers out of poverty. But more than a decade of effort by concerned stakeholders has failed to produce a foolproof fair-trade diamond certification scheme. Even the Kimberley Process—the UN-supported initiative to keep conflict diamonds off the market—is compromised. Some members of the coalition boycotted this year's plenary meeting because it took place in the United Arab Emirates—"the go-to place for illicit gold and diamonds," according to the dissenters—in protest over the country's dodgy import controls, which commonly allow conflict diamonds onto the market.

Given the bleak prospects for truly feel-good diamonds coming out of Africa's mines, man-made diamonds could be an alluring alternative. But Rapaport views diamond manufacturers as remorseless technocrats, freeloading off of mined diamonds' value while doing nothing for impoverished miners. In countries like Botswana, he says, 40 percent of government revenue is derived from the diamond industry. The solution, he insists, isn't to stop mining (or, in his parlance, "'Hey, you million and a half diggers and the seven million people you're supporting, all of you go to hell—we're going to sell synthetic diamonds!'") but to convince people to buy diamonds that actually help people.

When I present this argument to Martin Roscheisen, who's never visited a mine, he shrugs it off as twisted logic. "That also would justify releasing the Mexican drug leaders from jail," he says, smiling. "After all, they employ a lot of people."

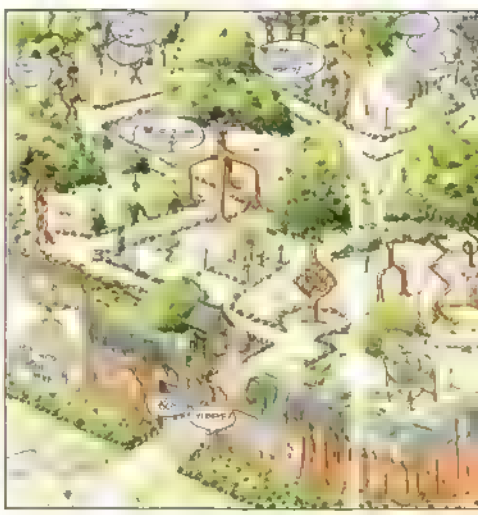
Besides, he insists, Diamond Foundry's clients "are people who would not buy a mined diamond." The company's first production run sold out within two weeks, at prices exceeding those of natural diamonds.

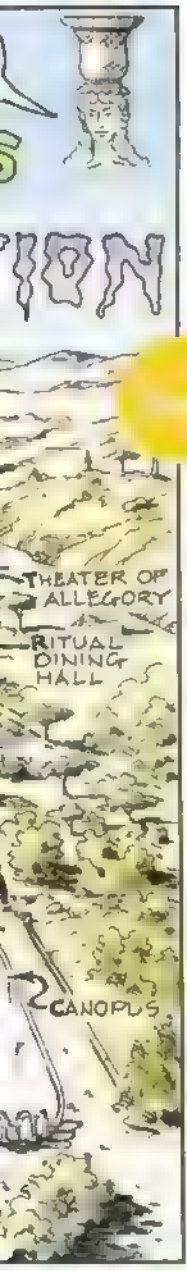
"The only diamond they would want to have is a diamond like ours," Roscheisen says, rising at the sound of the door buzzer. And with that, he excuses himself. The FedEx guy has just arrived with a gift for his girlfriend: a custom diamond, born in California. ❁


THE DESIGNED LANDSCAPE HAS THE POTENTIAL TO INDUCE A POWERFUL TRANSCENDENTAL EXPERIENCE & BRING FORTH A SYMBOLIC REBIRTH. JOURNEY WITH ME TO THESE .
LANDSCAPES
of
TRANSFORMAT
Elysian Fields at HADRIAN'S VILLA
UNDERWORLD LABYRINTH
SUBTERRANEAN PASSAGEWAYS INTO THE UNDERWORLD
ENTRANCE TO PLUTO'S CAVE
A MYSTERIOUS SACRED LANDSCAPE ABOVE THE CANOPUS AT HADRIAN'S VILLA HAS BEEN IDENTIFIED AS THE LOCATION OF THE LONG LOST ELYSIAN FIELDS WHERE MYSTIC RITES WERE ONCE PERFORMED.
WHAT TOOK PLACE HERE?

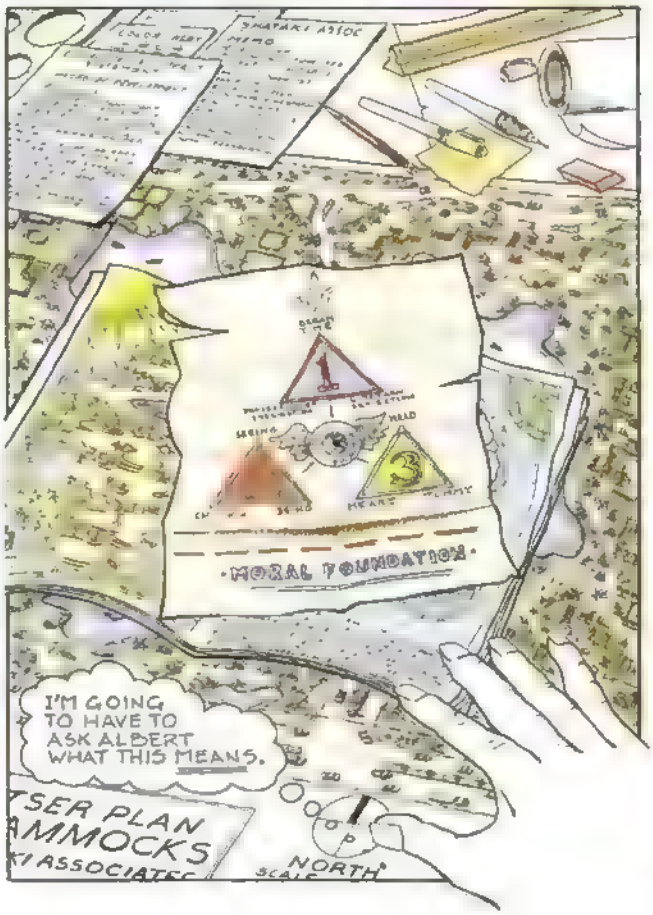
18th cent
CLAUDE LENS
GOLD
THUS, THE SAYING "Looking thru rose colored glasses."
THE CLAUDE MIRROR
REVERSES & REFLECTS A MINIATURIZED IMAGE THAT CAN BE HELD IN THE HAND. THIS CAPTURED VIEW ENVELOPS A WIDE PROSPECT, REDUCING SHADOWS & IMAGING PERIPHERAL VISION INTO FOCUS. THIS HEIGHTENED VISUAL AWARENESS ALSO ENCOURAGES CONTEMPLATION & METAPHYSICAL THOUGHT.
"ALL GARDENING IS LANDSCAPE PAINTING." Alexander Pope 1713 40

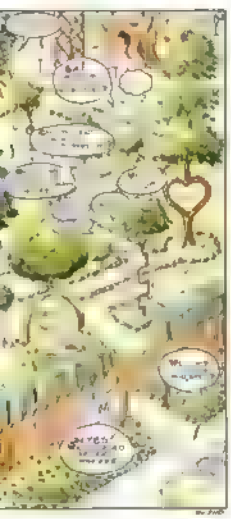
Sullivan's inspiration for his landscape cartoons comes from his grandfather. "When I told him I was going into landscape architecture, one of the last things he said to me was 'Don't forget your art.'"





SINCE THEIR FIRST APPEARANCE, HOT AIR BALLOONS HAVE BEEN AN INTEGRAL FIXTURE IN OUR GARDENS, PARKS & OPEN SPACES. THE FIRST AERIAL VIEWS OF THE LANDSCAPE THOROUGHLY ALTERED OUR PERCEPTION OF THE EARTH'S SURFACE. JOIN US AS WE EMBARK ON AN ADVENTURE WITH THESE DARING BALLOON AERONAUTS AS THEY VENTURE THROUGH...
LANDSCAPES FROM
ALOFT
THE FIRST VIEWS OF THE LANDSCAPE FROM BALLOONS SEEMED LIKE STRANGE ABERRATIONS. AERIAL PERSPECTIVE OPTICALLY FLATTENED THE TOPOGRAPHIC FEAT RES OF HILLS & VALLEYS. THESE SWEEPING PANORAMAS REVEALED THE COMPLEX PATTERNS OF FORESTS, FARMS, ROADS & WATERWAYS. BUILDINGS VIEWED AXONOMETRICALLY WERE TRANSFORMED INTO PLAN VIEWS. THE LANDSCAPE COULD NOW BE COMPREHENDED AS A COMPLEX MATRIX.



READ THIS!

# GARDENS OF DELIGHT

*A new book reimagines the lay of the land.*

BY **REGAN HOFMANN**

It may not seem the most likely subject for the next big animated series, but in the hands of UC Berkeley professor Chip Sullivan, landscape architecture comes to life. Drawing is "a way of learning to look at the environment," he says, and his new book, *Cartooning the Landscape,* is a graphic novel-slash-memoir about a student learning to see—and change—the world as he engages with parks, gardens, and public spaces. Interspersed with classic comic-book-style panels about the young man and his mentor, the book teaches architecture lessons through intricate drawings of historic and contemporary landscapes. It's all depicted in a style influenced by Walt Disney (as a kid, Sullivan would sit on his dad's lap and watch him make Disney characters) and *MAD Magazine*.

Sullivan sees his work as a way to foster love for the environment. It's also a way to connect with a younger generation. "It used to be considered deviant to read comics," he marvels. "Now that's changed, and it seems like my students listen to me more."

*Cartooning the Landscape*, by Chip Sullivan (University of Virginia Press, $30)

HEAR, HEAR

## A PRESIDENTIAL PODCAST

Former *Daily Show* head writer Elliott Kalan and *Alice + Freda Forever* author and historian Alexis Coe host a new Audible Original podcast that reveals the actual, flawed humans behind our esteemed commanders in chief. Warren G. Harding authored NSFW love letters, FDR was a terrible bartender, and more!

LISTEN: "Presidents Are People Too!," audible.com

HOT DATE!

JULY 12 DIFFERENT-COLORED EYES DAY!

## Alexander the Great, Joe Pesci, and "Lord of the Dance" Michael Flatley all have heterochromia (that is, different-colored eyes).

POP CULTURE SYLLABUS

# SURFING

### CHAIRMEN OF THE BOARD

For centuries, surfboards were built according to traditional Polynesian design—that is, they were made of wood. But in the late 1940s, American surfers began using materials developed for the war effort, like fiberglass and polyurethane foam. Curated by former pro surfer Richard Kenvin, a new exhibit looks at the boards' artists, from Caltech-trained surfer Bob Simmons, for whom a break[1] off the coast of La Jolla, California, is named, to the developers of eco-friendly alternatives, such as algae-based Arctic Foam.

VISIT

### EASY RIDERS

In the 1960s, California's Brotherhood of Eternal Love ran a giant drug ring in plain sight because federal agents refused to believe the laid-back surfers could be so organized. *The World in the Curl* outlines the sport's impressive résumé while debunking some myths (Christian missionaries in Hawaii didn't suppress the sport in the 19th century; people just got busier). Plus, did you know that when Thomas Jefferson wrote "the pursuit of happiness" into the Declaration of Independence, he was inspired by descriptions of surfing in Captain Cook's reports of the Polynesian Islands?

READ

### GUITAR HERO

The most recognizable riff in surf rock, the melody to Dick Dale's 1962 hit "Misirlou" was first recorded in 1919 by Egyptian musician Sayed Darwish. But the Mediterranean folk tune, the name of which means "Egyptian Woman," has been around for hundreds of years. Dale, the son of Lebanese immigrants, heard the song as a child, and the syncopated guitar style that became surf rock's signature sound came from traditional darbuka drum rhythms. Before Dale (and, later, *Pulp Fiction*) made it a mega-hit, it was arranged as a Greek big-band song.

LISTEN

1 underwater obstruction like a coral reef that causes a surfable wave

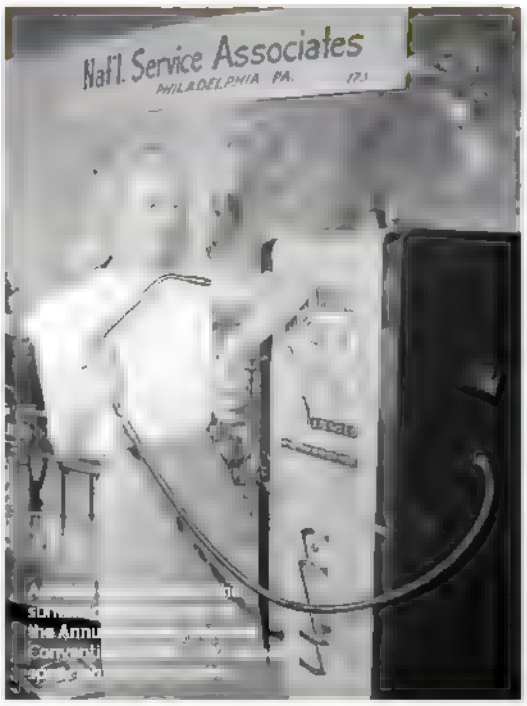
TIME MACHINE

# Vintage Beach Gear

You've got your SPF, your paperbacks, your rash guard, your beverage cooler. But in the olden days, you would have carried these instead.

**1 BATHING MACHINE** (1750): In 18th-century England, seawater was believed to be the cure for whatever ailed you. But bathing suit technology hadn't caught up, and most people who went for the cure had to bathe in the nude. The solution? A wheeled carriage that pulled up to the water's edge in which bathers could disrobe and jump directly into the water.

**2 SUNTAN LOTION VENDING MACHINE** (1940s): In the heyday of the automat, everything was robotized. For beachgoers, that meant a vending machine containing sunscreen could be directed at exposed areas, and the coin-operated spray (choose your SPF!) would protect you in a matter of minutes.




**3 MONOKINI** (1964): Fashion designer Rudi Gernreich dedicated his career to breaking taboos about the body. His first bathing suit design for women removed the corset-like structure from contemporary suits, foreshadowing modern swimwear. His second attempt, an invention he called the monokini, removed the top half altogether. Though 3,000 suits were sold, only two were ever worn in public. One of the wearers was arrested.

**4 SUNBATHING BOWL** (1970): Remember when tanning with foil sun reflectors seemed like a good idea? (It's not.) But what if the reflective surface held *you*? Designed by a *Popular Science* consultant, the foil-lined sunbathing bowl fit the whole family. And if it started to rain, you could flip it over and hide underneath until the storm passed. —REGAN HOFMANN

THE PAPER TRAIL

# 5 THINGS TO READ RIGHT NOW

BRAIN CANDY → BRAIN KALE

**Fries!**
by Blake Jingle
(Princeton Architectural Press, $16.95)

In his comprehensive guide to the fry, Jingle serves up tasty details on one of our favorite foods. Did you know that the potato's progeny made an appearance in none other than Thomas Jefferson's journals?

**Soccermatics**
by David Sumpter
(Bloomsbury, $27)

Drawing parallels between soccer and math—like how the revolutionary "Total Football"[1] strategy echoes the mathematical structure of ant colonies—this hybrid primer delights with numbers.

**Life Moves Pretty Fast**
by Hadley Freeman
(Simon & Schuster, $16)

For every classic 1980s flick, Freeman points out there's a key lesson: *Back to the Future* teaches that "parents are important," while *Baby Boom* imparts that "successful women are sexy as hell."

**Hidden Hemingway**
by Robert K. Elder, Aaron Veitch, and Mark Cirino
(Kent State University, $39.95)

This treasure trove from Hemingway's archives features a breakup letter from the woman who inspired the love interest of *A Farewell to Arms*.

**Face Value**
by Autumn Whitefield-Madrano
(Simon & Schuster, $25)

Whitefield-Madrano reveals how much of what you thought you knew about beauty—symmetrical faces are the most attractive; men are driven wild by a certain waist-hip ratio—is rooted in faulty research.

[1] A game-changing soccer theory that allows all players (except for the goalkeeper) to play anywhere on the field.

ASSOCIATED PRESS (SUNTAN); ARTFLY

# THE QUIZ

BY LUCAS ADAMS

START HERE

**1 In Old English, the word *earthling* referred to what?**

[A] Gnomes

[B] Marmots

[C] Dwarves

[D] Farmers

**2 In 1943, a sailor named Poon Lim survived 133 days alone on a raft by catching fish with a what?**

[A] Flashlight

[B] Mirror

[C] Paper clip

[D] Bobblehead doll

**3 What does an entomophagist like to eat?**

[A] Insects

[B] Offal

[C] Soy products

[D] Alfalfa sprouts

**4 How did Voltaire describe Shakespeare's plays?**

[A] "Pure sleeping potion"

[B] "An enormous dunghill"

[C] "Proof of French superiority"

[D] "Crap. Just crap."

**5 Robyn Smith was the first woman to be featured on the cover of *Sports Illustrated*. What did she compete in?**

[A] Stock car driving

[B] Rock climbing

[C] Swimsuit modeling

[D] Horse racing

**6 Scientists at Carnegie Mellon University are working to make what edible?**

[A] LED bulbs

[B] Batteries

[C] Thermometers

[D] GPS devices

**7 Eight U.S. states get their water from what?**

[A] The Ogallala Aquifer

[B] The Mississippi River

[C] Lake Superior

[D] Lake Erie

**8 If a hobo calls you a "duster," what are you?**

[A] A coward

[B] Smelly

[C] A boxcar thief

[D] Rich

**9 In 1887, Friedrich Nietzsche's sister, Elisabeth, and her husband, Bernhard Förster, moved to Paraguay to found which of the following?**

[A] A moustache wax factory

[B] An Aryan colony

[C] A nihilism studies program

[D] An Übermensch rehab program

**10 How did hairdresser Phil McCrory help combat the 1989 Exxon Valdez oil spill?**

[A] By hiring glam-metal bands to protest

[B] By giving Exxon's CEO a bowl cut as revenge

[C] By stuffing hair into panty hose to sop it up

[D] By making fur wigs for affected otters

**11 In 1977, Miskel Spillman—a non-celebrity grandmother—hosted a special episode of what television show?**

[A] *America's Funniest Home Videos*

[B] *The Tonight Show*

[C] *Dateline*

[D] *Saturday Night Live*

**12 In 1950, a town in New Mexico renamed itself after what radio quiz show?**

[A] *Truth or Consequences*

[B] *Spill the Beans*

[C] *Do You Trust Your Wife?*

[D] *The Eyes Have It*

**13 In 1947, the U.S. Air Force did what with cats?**

[A] Sent them into microgravity

[B] Tested the effectiveness of kitty litter at 10 Gs

[C] Dropped them from a flying B-29 to see if they'd land on their feet

[D] Studied their response to the speed of sound

**14 Which first lady spun records as a call-in DJ for public radio?**

[A] Michelle Obama

[B] Laura Bush

[C] Nancy Reagan

[D] Eleanor Roosevelt

ALAMY ET ELEANOR MCCARTNEY'S STOCK; MICHELLE OBAMA BY SHEALAN CURTIS/NBC TOMATOES.COM/LOS ANGELES)

**15 Ōkunoshima, a small island in Japan, is infested with hundreds of what?**

- [A] Feral rabbits
- [B] Ligers
- [C] Syrian hamsters
- [D] Miniature ponies

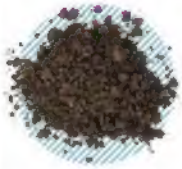
**16 Woodpeckers share a symbiotic relationship with what?**

- [A] Fungus
- [B] Sparrows
- [C] Worms
- [D] Radio waves

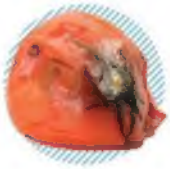
**17 Sri Dalada Maligawa temple in Sri Lanka is dedicated to what?**

- [A] Buddha's tooth
- [B] Budai's belly
- [C] Vishnu's arms
- [D] Ganesh's elephant trunk

**18 Scientists are currently working to generate electricity with what?**



[A] Dirt



[B] Rotting tomatoes

[C] Clouds

[D] Anchovies

**19 Richard Nixon played the lead role in a school production of what play?**

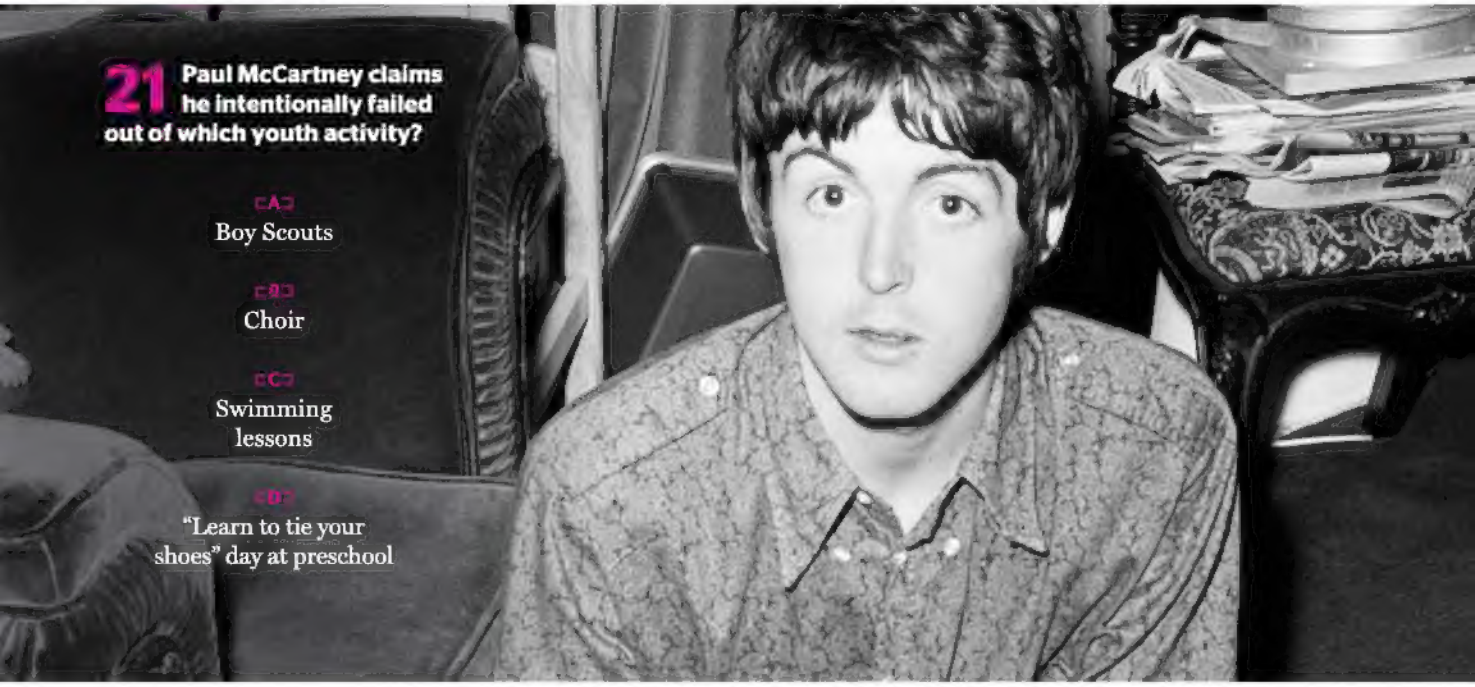
- [A] *The Tempest*
- [B] *The Aeneid*
- [C] *The Wizard of Oz*
- [D] *Our American Cousin*

**20 Before he was president of Ukraine, what was Petro Poroshenko's job?**

- [A] Cruise ship juggler
- [B] Chocolatier
- [C] Circus clown
- [D] Sommelier

**21 Paul McCartney claims he intentionally failed out of which youth activity?**

- [A] Boy Scouts
- [B] Choir
- [C] Swimming lessons
- [D] "Learn to tie your shoes" day at preschool



**ANSWERS**

**1.** D
**2.** A (He used a spring inside the flashlight as a fishhook.)
**3.** A
**4.** B
**5.** D (She was also Fred Astaire's wife.)
**6.** B
**7.** A (The states are Wyoming, South Dakota, Nebraska, Colorado, Kansas, New Mexico, Texas, and Oklahoma.)
**8.** C
**9.** B (They called their colony Nueva Germania. It failed.)
**10.** C (McCrory's "hair blankets" have cleaned up multiple spills since.)
**11.** D (She had won *SNL*'s "Anyone Can Host" competition.)
**12.** A
**13.** A (The government used the study to understand how astronauts could move in zero gravity.)
**14.** D (She did it for a polio charity.)
**15.** A
**16.** A (The fungi help soften the wood and make hole-boring easier for the woodpeckers. Meanwhile, the birds spread the fungi to new trees.)
**17.** A
**18.** B (They are developing a fuel cell that uses tomato waste as a source of energy.)
**19.** B (Nixon played Aeneas and described performing in the show as "sheer torture.")
**20.** B
**21.** B

**YOUR SCORE!**

**0-5** Pretty Good
**6-11** The Best
**12-16** The Worst
**17-21** Also Pretty Good

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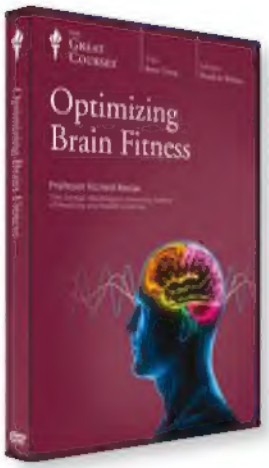


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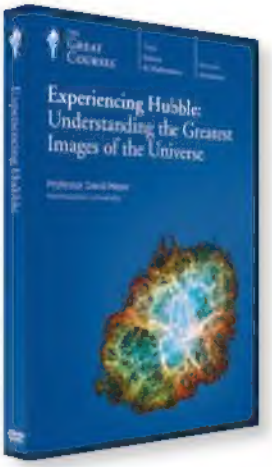


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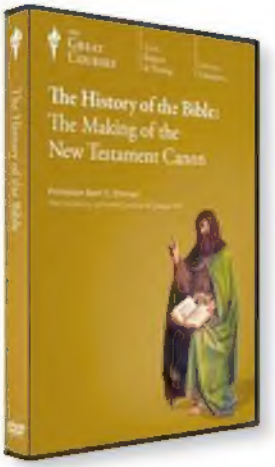


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